A Handbook

of

Tropical Gardening and Planting

A HANDBOOK

OF

TROPICAL GARDENING AND PLANTING

WITH SPECIAL REFERENCE TO CEYLON

BY

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AUTHOR OF "ILLUSTRATED GUIDE TO THE ROYAL BOTANIC GARDENS, PERADENIYA," ETC.

SECOND EDITION

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PREFACE TO FIRST EDITION

The need for a practical work of this nature, especially adapted for the Tropics, has apparently been long felt, judging by the demand for information on the subjects treated in this handbook. Of books on horticulture in temperate countries, there is no end, but they are generally of little guidance in tropical regions, where the conditions of climate, labour and methods of working are so different. A writer in the *Ceylon Observer* recently remarked: "How much more attractive and interesting our bungalow gardens and compounds might be made if the right sort of information regarding their care were available. Too often they are tended only by the garden-cooly, who has no pretensions to any knowledge of gardening, and things which grow, do so more by luck than good management." The aim of the author has been, therefore, to supply as concisely as possible and in a manner to suit the practical man in the field or garden, the kind of information which is most generally sought for, not only on horticultural matters, but also on general planting or agricultural subjects.

In practice there is no sharp line of distinction between Planting or tropical farming and Horticulture, and the main principles underlying both are the same. "Agriculture in the tropics," said SIR WILLIAM THISELTON DYER, "is essentially extended gardening; it has little relation to the agriculture of temperate countries, and its methods are those of horticulture." According to LIEBIG, "perfect agriculture is the foundation of all trade and industry, the foundation of the riches of state." "Scientific horticulture," said DR. BAILEY, "joins hands with the plant biologists on the one hand, and with commerce on the other."

Gardening or horticulture is obviously advancing in Ceylon, as in other tropical countries, and it is being recognised, slowly but surely, that it plays an important part in home adornment and comfort, as well as in rural improvement and sanitation. Nowadays

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many planters, mercantile and professional men, manifest a keen interest in their garden, and in some cases become experts in the cultivation of certain classes of plants which claim their special attention. Superintendents of estates or plantations in lonely districts admit that the presence of choice flowering plants or trees about their bungalow have an exhilarating influence, and when these are absent it is usually due not so much to indifference on the part of the superintendent as to circumstances over which he has no control. In Rubber districts especially, the depressing effects of long interminable stretches of sombre-looking rubber trees is well-known, and recently several companies have shown a desire to have attractive flowering trees (as urged by the writer in a recent pamphlet) planted around the bungalows of their superintendents.

For ladies, gardening has special attractions; the cultivation and arrangement of flowers is not only especially appropriate to them, but they are also frequently successful competitors with men in the art.

I leave it in the hands of readers to judge of the merits of this work, if it has any. The general arrangement of the plants or crops, useful or ornamental, into sections according to the elevation and purpose for which they are especially suited, will, I trust, be appreciated. To facilitate reference and save the time of readers, considerable use has been made of tabular forms which contain only the most essential particulars. The planting products in Chapters XXII and XXIII are considered in accordance with their importance in Ceylon. Though a botanical arrangement has been avoided in preference to an economic or practical one, the botanical name and Natural Order or family of each plant or product mentioned throughout the book are invariably given. Most people nowadays know the meaning of plant affinity, and to these a knowledge of a plant's scientific name and family often conveys some idea as to its general character or utility. The common or vernacular names, when sufficiently popular or well-known, are given in English, Sinhalese, and Tamil, also in some cases in Hindustani and Malay.

My thanks are due to several gentlemen as well as ladies who have kindly supplied me with valuable suggestions and information. Lady Blake has favoured me with useful notes on various ornamental plants, and Mrs. Westland and other ladies have contributed recipes for jams, jellies, preserves, etc. I am especially

indebted to Mr. E. E. Green, f.e.s., f.z.s., Government Entomologist, and Mr. T. Petch, b.a., b.sc., Government Mycologist, who obligingly furnished me with much of the information in the chapters on *Insect Pests* and *Fungus Diseases* respectively; to Dr. R. H. Lock, m.a., sc.d., Assistant Director, Royal Botanic Gardens, for useful guidance; to Mr. M. Kelway Bamber, m.r.a.c., f.i.c., etc., Government Chemist, who has read, and contributed to, the chapters on *Soils* and *Manures*; to Mr. J. K. Nock* Curator of Hakgala Gardens, for much information on Up-country fruits, vegetables, etc.; to Mr. C. Drieberg, b.a., f.h.a.s., Secretary of the "Ceylon Agricultural Society" and Superintendent of School Gardens, who has written the Calendar for the Low-country and afforded assistance in other ways; and to the Hon. the Principal Collector of Customs, Colombo, who has courteously obliged me with statistics of exports. Finally I desire to acknowledge the constant courtesy of Messrs. H. W. Cave & Co., the printers, whose work I think speaks for itself.

For the loan of several excellent half-tone and electro blocks, I have to thank *The Agricultural Economist & Horticultural Review*, *The Gardener's Chronicle*, *The Ceylon Agricultural Society;* also Messrs. Plate & Co., Messrs. Walker Sons & Co., and Messrs. Brown & Co. My thanks are likewise due to Mr. H. W. Cave, m.a., Messrs. F. Skeen & Co., the Colombo Apothecaries Coy. and Mr. T. Petch for permission to use certain photographs. With the exception of these, the photographs for all the illustrations have been taken by myself.

Among useful works of reference which I have consulted, I would especially mention the following:—Watt's *Dictionary of Economic Products of India*, Cameron's revised edition of *Firminger's Manual of Gardening for India*, Woodrow's *Gardening in India*, Nicholl's *Tropical Agriculture*, Mukerji's *Indian Agriculture*, Haldane's *Sub-tropical Cultivations and Climates*, Nicholson's *Encyclopædia of Gardening*, Watson's revised edition of *Thompson's Gardeners' Assistant*, Ferguson's *Ceylon Handbook and Directory*, Freeman and Chandler's *The World's Commercial Products*, Bailey's *Pruning Book*, Maxwell-Lefroy's *Indian Insect Pests*, Pearson's *Book of Garden Pests*, Soraur's *Physiology of Plants*, Willis' *Agriculture in the Tropics*, Trimen's *Flora of Ceylon* and Wright's *Hevea brasiliensis*.

H. F. M.

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*Whose lamented death has since occurred.

PREFACE TO SECOND EDITION

The rapid exhaustion of the first edition has given the author an opportunity of enlarging and fully revising the work, the book being now considerably increased in size. Some of the chapters have been entirely re-written and extended, and several new features have been added, among these being the following subjects: Use of explosives in agriculture, inter-crops and catch-crops, dry-farming, intensive or French gardening, sericulture, lac-culture, selections of trees, plants, etc., for cemeteries or memorial purposes, selection of Ceylon indigenous plants, poisonous plants, sacred trees, remarkable or curious seeds and fruits, insectivorous, fly-catching, and myrmecophilous plants. The illustrations also have been almost doubled in number.

I have to express my indebtedness especially to MESSRS. JOHN PARKIN, M.A., N. C. ROLT, and C. DRIEBERG, B.A., for valuable assistance and suggestions; also to MESSRS. R. N. LYNE, Director of Agriculture, for kind encouragement; C. H. KNOWLES, B.SC., Superintendent of Agriculture, Fiji; GEO. BRYCE, B.SC.; and J. W. IRWIN, of Coorg, for a photograph of coffee cultivation. For the loan of some excellent blocks, I have to thank MESSRS. SUTTON & SONS, Reading; RYDER & SONS, St. Albans; BROWN & Co. and WALKER & SONS, LTD., Colombo.

H. F. M.

Royal Botanic Gardens,
Peradeniya,
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ERRATA

PAGE

118 for Casuarina equisitofolia *read* C. equisitifolia.
120 for Malpighia coccinea *read* Malpighia coccifera.
124 line 5, for Soil of potting plants *read* "Soils for pot plants."
215 line 12 from bottom, for Tamba-karawila *read* Tumba-karawila.
248 18 ,, ,, for Oca-quina *read* Oca-quira.
317 after Allamanda Schottii *read* A. violacea; flowers rosy-purple; height 5 to 7 ft.
325 line 2, for ilicifolio *read* ilicifolia.
359 for flabilefer *read* flabellifer.
378 for Alocasia Argyrea *read* A. argyrea.
389 Sceutellaria should be Scutellaria.
398 for Ailanthus *read* Ailantus.
399 for Chamaecyparis Lawsoniana *read* Cupressus funebris, and under the former read: A handsome pyramid-shaped small tree, with crowded fern-like leaves; 4-6,000 ft.
,, line 11 from bottom, for C. knightiana *read* Cupressus knightiana, and for C. in following leading lines *read* Cupressus.
404 for Philadelpus *read* Philadelphus.
405 line 11, for Wiganda *read* Wigandia.
421 for Lebelia *read* Lobelia.
431 for Tigrida *read* Tigridia.
435 for Cyclamen *read* Cyclamen.
537 after Asclepias curassavica *read* perennial, not perennia
,, ,, Brayera *read* N. O. Rosaceae.
547 line 6, for Agave rigida var. Sisalana *read* Agave Sisalana.
564 line 5, for Nectrandra *read* Nectandra.
572 under Lemon-grass *read* Cymbopogon, not Andropogon.

A HANDBOOK

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TROPICAL GARDENING & PLANTING.

CHAPTER I.

CLIMATE AND SOILS

Climate.—Climate is the principal factor which controls the growth of plants, and constitutes the conditions which render a country suitable for the abode of man and animals. One of the first questions the planter or gardener in the tropics has to consider is whether the climate is suitable for the cultivation he intends to take up. Climate mainly depends upon latitude and altitude; it is usually hottest at the equator at sea-level, and coldest the furthest away from it and the highest above sea-level. It is also, however, materially affected by the distance from the sea, form and slope of the land surface, the nature of the soil and its vegetation, and other circumstances. The influence of altitude is specially noticeable in the tropics, the temperature becoming appreciably cooler as one ascends in the hills. Thus, while at Colombo it is hot and tropical, at Nuwara Eliya, 6,000 feet above the level of the sea, it is cool and temperate. For about every 300 feet of elevation there is a reduction of about one degree in the temperature, and it is estimated that for about every 270 feet elevation the effect on the temperature is equivalent to receding a degree from the equator. Thus, Kandy being about 1,500 feet above sea-level, its average shade temperature is about 5 degrees cooler than that of Colombo. At Nuwara Eliya the difference is even more marked, so that if

Pidurutalagala, our highest mountain (8,296 ft.), were about 8,000 ft. higher still, it would probably be covered with perpetual snow. The cooler climate of the hills not only renders possible the cultivation of certain plants or crops which are indigenous to temperate regions, but also affords residents and visitors a very grateful substitute for the more bracing climate of a temperate country. The flat northern and eastern portion of Ceylon are characterized by a dry arid climate, to which typical forms of thorny vegetation or scrub are indigenous. Here, however, certain crops may thrive under special methods of cultivation better than in the wet zone, being specially adapted (xerophytic) to the arid climate, as for example the useful Palmyra palm, which in the dry zone luxuriates and forms a valuable product.

In Ceylon there thus occur four distinct types of climatic zones, viz:—(1) the *hot and moist zone*, from sea-level to about 1,000 feet elevation with a well distributed rainfall of 70 to 120 or more inches, and a mean shade temperature of about 80° Fah.; this is confined to the south-western part of the island; (2) the *hot and dry zone*, formed by the flat country of the northern and eastern part of the island, with a rainfall confined to only a few months of the year; (3) the *intermediate zone*, from 1,000 to 4,000 feet, with a rainfall of 80 to 130 or more inches; (4) the *montane* or *cool zone*, from about 4,000 feet to the highest altitude (8,296 feet), with an evenly distributed rainfall of 85 to 150 or more inches. In the months of January and February, cool night temperatures are usually experienced in the low-country; thus at Colombo a night temperature of 65° F. and at Kandy of 50° F. have been recorded; whilst at Nuwara Eliya a slight frost frequently occurs in the period named. Such a diversified climate allows of the successful cultivation of a large variety of plants or crops from different latitudes, and within a comparatively small area. Consequently there may be seen in Ceylon a considerable number of acclimatized plants from Brazil, Mexico, Pacific Islands, Malay, Tropical Africa, India, etc., luxuriating in the low-country; whilst at the higher elevations many species from cooler regions, as Europe, South Africa, Australia, Peru, etc., are perfectly at home, many having become naturalised.

Seasons.—Sir Emerson Tennant said: "The line is faint that divides the seasons in Ceylon. No period of the year is divested of its seed time and its harvest in some part of the Island, and the ripe fruit hangs on the same branches that are garlanded with

open buds." Thus there are no seasons in Ceylon, in the sense the word is used in temperate countries. The uniform moist climate of the south-western districts is only varied by a period of comparatively short rainfall between January and March, known as the "dry season." No "cold season" occurs here as in India, though during the dry season named, as well as the hotter months (March to May), most people prefer to enjoy the more bracing air of the hills, which is then dry and crisp. So that the only variety in the climate is afforded by the two annually recurring monsoons, viz., the *south-west monsoon*, commencing at the end of May and lasting till October, and the *north-east monsoon*, lasting from October to May. The rainfall of the former is more or less confined to the south-west of the Island, while the eastern side of the country receives its most copious rain from the north-east monsoon, chiefly in November and December, its driest seasons being from June to September. In the northern part of Ceylon, the rainy season is mostly confined to the three months of October to December, very little rain falling from April to September. The hottest period of the year, all over Ceylon, is from March to May.

LOCAL INFLUENCES ON CLIMATE

Forests.—These constitute one of the most important conditions affecting climate. The presence of forests prevents erosion of the soil, retards the evaporation of moisture, enables the soil to retain a large proportion of rain water, and tempers the atmosphere both by cool vapours from the soil and by preventing the sun's rays from reaching the earth. It is also claimed that forests cause precipitation of the clouds, resulting in more frequent showers and heavier rainfall than would otherwise be the case; but this is a disputed point. When the forest is cleared away, radiation from the land is increased, the soil is less retentive of moisture, and the air, as well as the soil, becomes drier and warmer. A similar effect takes place when swampy and marshy land is drained and brought into cultivation. The climate of islands and maritime districts is usually much more equable than that in the interior of continents, the atmosphere in the former being frequently loaded with clouds and vapours. Lakes, marshes and rivers have usually an unfavourable effect on climate, as they give rise to fogs, especially at night, which chill the ground and render the vicinity unhealthy.

Aspect.—This also has an important influence on climate, a northern and an eastern aspect being, as a rule, cooler and moister than southerly and westerly ones; in a north verandah, for example, plants which require a cool temperature thrive much better than in a verandah facing south. In a mountainous country, aspect is, of course, often affected by the lay of the land, and ridges, alternating with valleys or ravines, often cause an appreciable difference in the climate of places relatively near to each other. Similarly in a narrow valley, while one side, being partially shaded, may be cool and damp, the other side is warm and dry; so that plant-life would differ materially on either slope.

Wind-breaks.—The climate may be considerably improved locally by the planting of shade and wind-break trees, for these not only break the force of the winds, but also tend to lessen the excessive evaporation of moisture, and temper the sun's rays. Exposed and windy situations have a different climate from sheltered places, although the soil, rainfall and aspect may be about the same. Wind-breaks may be said to be as essential to many plantations as a break-water is to an open harbour

Soil formation.—Climate is also affected by the nature of the soil. There is a greater radiation of heat from sandy than clay soils, so that districts with sandy soils invariably have the highest temperature. This largely accounts for the intense heat in parts of Egypt, Bengal, Arabia, etc., during certain seasons of the year.

Irrigation, it is admitted, has a marked beneficial effect on climate; thus the enormous lake-like dams or reservoirs, like that at Assouan in Egypt for accumulating the Nile waters, and others in India and Ceylon, must have an important influence in cooling the surrounding atmosphere.

Table showing Elevation, Average Rainfall, and Mean Temperature at the Principal Towns or Stations in Ceylon.

STATION	Elevation in feet	Average Rainfall Inches	Average Rainfall Days	Mean Temperature, in Fahr. degrees
Colombo -	20	87	174	81
Galle -	48	92	200	80
Matara -	15	71	117	80 approximate
Hambantota -	50	37	88	80
Batticaloa -	26	59	101	80
Trincomalee -	12	63	108	81
Jaffna -	11	47	71	82
Mannar -	12	38	65	82
Puttalam -	27	47	81	81
Chilaw -	10	55	90	81 approximate
Negombo -	6	69	100	81 do
Ratnapura -	84	151	213	79
Kegalle (Ambanpitiya about 3 miles west of K'galle) -	729	122	163	79 approximate
Kurunegala -	381	81	155	80
Anuradhapura -	295	54	102	80
Matale -	1,208	84	164	76 approximate
Badulla -	2,225	75	122	73
Bandarawela -	4,036	62	132	67
Kandy -	1,654	81	191	76
Nawalapitiya -	2,400	154	175	74 approximate
Deltota -	3,500	109	199	73 do
Hatton -	4,141	152	215	69 do
Bogawantalawa -	4,300	111	227	65
Agrapatana -	5,200	87	196	60 approximate
Nuwara Eliya -	6,240	94	204	58

SOILS

Soils are formed by the gradual decomposition or wearing away of rocks, under the influence of weather, glacial or volcanic action, assisted by the presence of plant-life. Variations of temperature have an important effect on the formation of soils, for rocks expand by heat and contract by cold. Thus in the hot tropical sunshine, the surfaces of the rocks expand and are again contracted by the cool air of the nights ; this causes them to crack, and particles crumble off, thereby giving rise to a small but constant addition to the soil. Plant-life also assists in the formation of soils in two ways, i.e., mechanically and chemically. The roots enter crevices of rocks, and by their gradual increase in bulk act like wedges in forcing the two sides apart ; the force thus exerted, even by the roots of very small plants, is considerable, being sometimes sufficient to break through concrete, or lift stone pavements. Roots have also, by means of their acid sap, a solvent action on rocks, and thus assist in their decomposition. Vegetation further contributes to the formation of soil by depositing dead leaves and stems on the surface in the form of humus, to the presence of which is usually due the black colour of garden soils.

Other important factors in the formation of soils are rivers and streams, the sea, and, in some cases, wind. Rivers grind down rocks and stones, and carry particles of rock or gravel to the plains or valleys, depositing it in the form of mud, which is known as *alluvial soil*. Such deposits are usually rich in plant-food. The wind occasionally adds fertile matter to soils by carrying sand, dust, straw, leaves, etc., and depositing them in hollows.

All soils may be classed as either (1) *transported*, when they are carried from a distance, as by any of the agencies named above ; or (2) *sedentary*, *local*, or *indigenous* when they remain where formed. To the latter belong by far the greater portion of Ceylon soils. In some cases the surface soil is transported, while the sub-soil is sedentary, or vice versa. Transported deposits, as alluvial soils, are, as stated above, usually characterized by greater fertility than those which are sedentary.

CONSTITUENTS OF SOIL

The five substances of which all soils may be said to be composed of are : sand, clay, lime, vegetable matter or humus, and stones.

Sand.—This is principally composed of quartz, flint, or silica. It imparts a loose porous consistency to the soil, assists the air and water in finding their way through the land, and aids the roots of plants in their efforts to penetrate in all directions. In agricultural and horticultural practices, sand is frequently added to the soil so as to render it porous and "sweet." Thus in potting composts, sand is usually a necessary constituent.

Clay is composed of two chemical bodies, known as silica and alumina, in combination with water. When wet, it is sticky and plastic; but when burnt, as was formerly done in the cultivation of stiff soils, it loses its plastic property and becomes brittle. *Liming* has also this effect on clay soil, depriving it of its sticky, binding nature. There are various kinds of clay, some white, from which china-ware is made; others yellow, from which are made bricks, pots, chatties and other earthenware articles. Clay is colder, and retains much more moisture than sand. A certain proportion of clay is a highly desirable constituent in all soils, and no land can be efficiently and economically worked unless clay be present to an appreciable extent.

Lime.—This usually occurs in soils combined with carbonic acid as a carbonate of lime in various forms, as chalk, lime-stone, and coral. It is present in large quantities in the shells of land-snails and some marine animals, besides coral. Ceylon soils generally are lacking in lime, which when present usually occurs in the form of dolomite.

Humus or vegetable-mould is formed by decayed vegetable matter, such as leaves, roots, stems, etc., and exists to some extent in all cultivated soils as a dark brown substance. It often occurs abundantly on the surface of the ground in forests. Humus may be said to be the most important constituent of all soils for the planter or gardener. It has a great influence on the capacity of soils for retaining moisture, renders their cultivation easier, and encourages the activity of soil bacteria. Soils which are deficient in humus are liable to cake and become very hard in dry weather, and quickly lose their heat in cool weather. (See under *Manures*).

Leaf-mould may be distinguished from humus as being composed almost entirely of decayed leaves; it is a valuable ingredient in composts for pot-plants, tender seedlings, etc.

Stones are simply particles of the original rock from which the soil was formed. If they do not exist in too great a number

(10% of small stones not being considered harmful) they serve a useful purpose in the soil, as they render it lighter in character, affording porosity and assisting in the retention of moisture. The stones are weathered by the atmosphere and other agencies, in the same way as the rocks from which the soil was made, so that their gradual wasting away adds material to the soil.

CLASSIFICATION OF SOILS.

Soils are classified in accordance with their physical or chemical composition, and are divided into classes, sub-classes, etc., according to the proportion of clay, sand, lime and humus they contain. The principal classes are:—

Clay or argillaceous soils.—These contain over 50 per cent. of clay. They are heavy and dense, very retentive of water, are cold and difficult to work, and require to be well-drained in order to be properly cultivated. In periods of drought, plants on clay soils are apt to suffer, as the roots cannot penetrate into stiff clays, or obtain water from the subsoil. Though such soils may contain an abundance of mineral food for plants, it is often rendered unavailable by their stiff texture. This may, however, be corrected by the addition of sand, lime, or suitable manures, and by drainage. Clay soils of moderate texture have, nevertheless, very important advantages in the tropics, owing to their power of retaining soluble manures and moisture. (See under *Clay*).

Loamy soils are composed of 30 to 50 per cent. of clay, under 5 per cent. (if any) of lime, and the remainder of sand and vegetable mould.

Sandy loams contain from 20 to 30 per cent. of clay, and may be with or without lime.

Loamy sands comprise 10 to 20 per cent. of clay; lime may be present or absent.

Sandy soils.—These contain not less than 70 per cent. of quartz sand; they have little cohesion, are very porous, and contain little nourishment for plants. Such soils can be improved by the addition of clay, marl or chalk.

Marly soils.—These contain from 5 to 20 per cent. of lime, and may partake of the characters of the first four classes, or of the eighth.

Calcareous soils contain over 20 per cent. of lime, and may partake of the characters of a loamy soil with 30 to 50 per cent.

of clay, or sandy soil with over 70 per cent. of sand. On the authority of Mr. Bamber, the Government Chemist, neither marly nor calcareous soils occur in Ceylon.

Gravelly soil is a term applied to the presence of a considerable amount of gravel or stones in soils, without reference to their composition ; such soil may partake of the characters of the sandy, clayey, or calcareous classes.

Vegetable mould.—This applies to soils which contain not less than 5 per cent. of humus or vegetable matter ; they may in their turn partake of the character of clayey, loamy, or sandy soils; or they may be composed almost entirely of vegetable matter, as in the case of peat.

Peat is a black soil formed by the decay of marsh plants and bog mosses, as Sphagnum. A black plastic peat-like soil occurs on mountain plains in Ceylon at elevations above 5,000 feet, usually forming a flat barren area, but it in no way forms a substitute for peat. Peat bogs are not adapted for cultivation in their natural condition, although they are the favourite resort of certain plants. Rhododendrons and allied plants thrive best on well-drained peaty soils. To render peat-bogs fertile, the excess of water must be drained off, and lime and sand added. The effect of this treatment is to aerate the soil, destroying the injurious acids present, and preventing the stagnation of water.

Surface soil and sub-soil.—These are convenient terms, the former to distinguish the top layer of soil, which is usually distinct by its darker colour (owing to the presence of humus) and looser texture than that underneath, i.e., the sub-soil. The latter, though usually more compact and of a lighter colour, varies considerably in character. It may consist mainly of sand, or of gravel or clay, or even resemble the surface-soil. The surface-soil varies in thickness according to locality and surrounding influences ; in forests and highly cultivated lands it is usually deep, but on steep hill-sides and in dry places it is shallow.

Heavy and light soils.—Although sandy soils are heavier than clay ones, agriculturists and horticulturists call a clay soil "heavy," and a sandy soil "light." These terms, however, refer to the facility with which the soils are worked, and not to their relative weights.

Cold or warm soils.—Clay soils retain much more moisture than sandy soils, and this causes a great difference in regard

to their temperature. The former are therefore sometimes spoken of as *cold*, and sandy soils as *warm*. As a certain amount of warmth in the soil is necessary for plant life, this indicates the importance of draining low-lying, cold, clayey land.

Volcanic soils.—These are formed by the lava which has flowed over the surface of volcanoes, and subsequently become subject to the action of the atmosphere. Soils of volcanic origin, as those of certain islands, are usually very fertile. Such soils may practically be said not to exist in Ceylon.

Submarine or coral soils are found in certain islands which, by volcanic or other agencies, have been lifted up above the sea.

Chemical composition of soils.—All soils are composed of (1) *organic* and (2) *inorganic* elements. The former comprise oxygen, hydrogen, nitrogen and carbon, which disappear as vapour or smoke when an organised body, vegetable or animal, is burnt in the air. The first three are gases, and the last is a substance, one form of which, charcoal, is familiar to every one. Besides these, there are two other substances, namely, *sulphur* and *phosphorus* which are sometimes called *secondary organic* elements, because they are frequently, but not always, found in organised bodies. The inorganic elements which are always to be found in combination with other elements in lands suitable for cultivation are *potassium*, *sodium*, *magnesium*, *calcium*, and *iron*. With the exception of magnesium, calcium and iron, all these are *essential constituents* of plant-food.

Examination of soils.—The following simple mechanical tests are given as a ready means of ascertaining approximately the condition of a given soil:—Weigh out ¼ lb. of earth after it has been well dried, boil it for a short time in a pint of water, and then pour all into a glass vessel. Into this insert a piece of blue litmus paper; if the paper turn to a red colour, it shows that acid humus is present in the soil, and that lime is necessary to counteract the acidity. Then add more water, stir well, and pour off carefully the muddy water into a large vessel, care being taken that none of the sand which settles to the bottom is lost; stir up the sand with fresh water, which is again poured off into the larger vessel. This is to be done several times until the sand becomes clean and free from mud. The contents of the larger vessel are to be allowed to remain for several hours until the fine mud settles to the bottom, when the clear water is to be carefully

poured off. The sand and the mud should then be dried and weighed separately, when, by comparing their bulk or weight, the proportion of sand and earthy matter in the soil can be ascertained.

To discover the presence or absence of lime in a soil.—Besides the blue litmus paper test for lime, as described above, the presence of lime may be ascertained thus:—Take some 10 or 20 small samples from different parts of the ground, mix them well together, then place a small sample in a tumbler and pour on it a wine-glassful of muriatic (hydrochloric) acid. If the liquid fizz and bubble freely, the soil may be considered to contain a sufficiency of chalk; but if it only effervesces feebly, it is safe to conclude that a dressing of lime is desirable.

To ascertain proportion of humus in the soil.—Heat for an hour to a red-heat, a given quantity of thoroughly dry earth in an iron or clay vessel; the soil rapidly blackens if much humus is present, and then turns red or yellow, the vegetable matter being burnt off; when cool, weigh the earth, and the loss in weight will give the proportion of humus in the soil.

The capacity of soils for holding moisture.—This power of soils is mainly dependent on the mechanical texture or porosity of the soil material. In a soil consisting of solid particles of fairly uniform size, the interspaces are about 40 per cent. of the volume, whether the particles are large or small; but if the particles are a mixture of large and small (as gravel and sand), the volume of the interspaces is much diminished. On the other hand, if the particles themselves are porous, as in the case of chalk, loam, and especially humus, the volume of the interspaces is much increased. It is this volume of the interspaces that determines the amount of water which a soil will hold when perfectly saturated, or the amount of air which it will contain when dry. The influence of humus on the capacity of a soil for holding moisture is remarkable. SCHUBLER found that after 72 hours exposure to moist air, humus had taken up nearly 2½ times as much water as clay, and 40 times more than sand, which, under the same circumstances, took up 16 times less than clay. A simple way of ascertaining the power of any soil to hold water is given thus: Fill a flower-pot nearly to the top with dry soil, and then weigh it (the weight of the pot, both wet and dry, must, of course, be known). Then gradually pour water on the soil until it begins to drop from the bottom.

As soon as the dropping has ceased, weigh the whole; the difference in weight will approximately show the proportion of water held by the soil.

Capillary action of soils.—The power of soils for drawing up water from the lower strata towards the surface is of the greatest importance from the cultivator's point of view. It is possessed in a greater or less degree by all soils, being greater in proportion as their pores are finer. Sand possesses this power to the least extent, and fine clay to the greatest; thus a clay soil is always wetter than sandy soil placed under the same influences. There is, however, a limit to the fineness of particles which favours capillarity, and when this limit is passed, fineness is disadvantageous, since the minute particles of earth are then apt to cohere together so closely that few, if any, spaces are left between them for the admission of water. Therefore too open a tilth is not desirable, especially for light soils; hence the necessity for rolling such soils after ploughing and harrowing. From the subsoil, moisture is gradually and steadily sucked up and transmitted to the upper cultivated surface. When the surface soil is left undisturbed and becomes hard, much of its moisture passes off by evaporation. One of the chief objects of tillage or good cultivation is to cut off the column conducting the underground water at a point below the actual surface of the soil, so that the supply of moisture shall be brought to the roots of the plants instead of escaping freely into the open air. A mulch or any dry covering that can be placed between the atmosphere and the soil also has the effect of checking the evaporation of moisture. When soil is nearly dust dry, nitrification ceases; thus soil-stirring operations in dry weather not only preserve the soil moisture, but keep the nitrifying organisms employed. The process of soil capillarity may be illustrated by taking a lump of loaf-sugar to represent the hard-caked soil. Hold one end of the lump so that it touches the surface of a cup of water, when instantly the whole lump is moistened; then take about the same quantity of granulated sugar (equalling in height the thickness of the loaf sugar), and hold on a screen so that the lower surface of the sugar just touches the water; in this it will be found that the water rises very slowly, and not until some of the sugar is dissolved will it reach the top. KING calculated that 6·24 tons of water a day evaporated from 1 acre unstirred soil, while only 4·52 tons evaporated when the surface was raked or harrowed.

Fertility of soils.—The fertility of a soil depends, said LIEBIG, "on the bulk and composition of the previous crop residues, and the extent to which these have been subsequently destroyed." Evidently, therefore, the crop which leaves behind the largest amount of roots, foliage, etc., will best maintain or increase the organic capital of the soil. Fertility of soils has been summarised as being dependent on the following conditions, viz. (1) a sufficiency of available plant-food; (2) a suitable texture or mechanical state of the soil; (3) absence of injurious compounds; (4) a healthy percolative subsoil; (5) a suitable climate, season and aspect. The absence of any of these conditions will, to some extent, render a soil infertile. Needless to say, one of the most essential factors that control soil fertility is the amount of moisture present, for on this depends the healthy action of the nitrifying bacteria. Agricultural chemists now distinguish between *fertility analyses* and *complete analyses*, the latter only indicating the amount of plant food present in the soil, whereas the former aims at showing the proportions *available* to the crop—a very different thing.

Sterilisation of Soils.—An important fact in agricultural science which has recently come to light is the beneficial effect of the sun's light and heat on the surface soil. Hitherto the long spells of hot dry weather which periodically occur in the tropics, and during which the soil becomes extremely hard and dry, has been generally deplored, and it has been commonly felt that if only one could cover a fallow area with some crop that would stand the drought, the ground, protected by it from the scorching sun, would lose less of its moisture and be more fertile later on. Recent experiments have shown, however, it is claimed, that sterilizing the ground by intense heat restores or enhances soil fertility, the conclusion arrived at being that such sterilization kills off the organisms which prey on the useful bacteria in the soil, allowing the latter to increase more rapidly. From this it is deducted that the fertility of the soil is largely increased, and at no expense to the cultivator, since most of the bacteria are engaged in the useful work of fixing nitrogen from the atmosphere into a form suitable for plant-life or in converting unsuitable compounds into the nitrates which plants require.

It is thus concluded that so far from the scorching sun's rays being inimical to the fertility of the soil, by killing off larger organism, and enabling bacteria to grow and increase, they add

appreciably to it, and that by forking up or ploughing the surface layers so as to maintain these in a loose state, their action would reach to a greater depth, and be therefore more pronounced. It will often be seen in the tropics that after a long period of drought the soil will show signs of extraordinary fertility. It has been found in the case of soils which have become exhausted by intensive culture in glass-houses, that by heating these to a temperature of 140° Fah. fertility may be largely restored and all the eel-worms and other injurious insects present killed, the soil becoming again capable of producing healthy vigorous crops.

Exhaustion of soils.—The term is based on money values rather than on scientific conceptions, and has no precise definition. Although no soil can be entirely exhausted, generally speaking it becomes so, as regards any particular crop, whenever the cost of cultivation comes to as much as the crop is worth. Thus the word "exhaustion" refers to the available character of the plant-food present in the soil. Most cultivated soils contain a store of plant-food which it would take many crops to exhaust; but a large proportion of the elements of this food is present in such a form that plants are unable to make use of it. Thus an acre of land may contain many thousand pounds of phosphoric acid, potash, or nitrogen, and yet be in "poor condition;" while an application of a suitable fertiliser, supplying 50 pounds of readily available phosphate or nitrogen may greatly increase its productiveness.

Theory of toxic substances in the soil.—According to recent theory, infertility in a soil,—i.e., inability to produce good crops, —may sometimes be traced, not necessarily to the absence of plant-food, but to the presence of compounds injurious to plant-growth. These compounds are attributed to decomposition products of plant-tissue, excretions from growing roots and germinating seeds, etc. Crops are thus supposed to form toxic substances in the soil which are deleterious to the crop following. The presence of excessive quantities of organic matter in the soil, as applied in the form of organic manures, is also considered capable of producing similar toxic effects, and the action of suitable artificial manures, proper rotation of crops, good drainage, etc., is to neutralise or destroy these. A special advantage of crop rotation is that, while the excreta of one kind of crop may not be harmful to another, different species assist, it is considered, in the destruction and removal of the excretions of others.

Ceylon soils, as a rule, are poor and shallow, and their character in general may be summed up thus: (1) *Sea-coast*, soils loose and gravelly or sandy, often with a large proportion of laterite ("cabook"); these are usually of a deep reddish colour, and in some localities a deposit of white silvery sand occurs on the surface; in such soils, however, the Cinnamon, Coconut palm and certain other crops flourish, provided the rainfall is sufficient. (2) *Inland*, up to medium elevations in Southern and Central Provinces, soils of a reddish clay, often with a proportion of laterite, and containing but a small percentage of humus. (3) *Up-Country*, soils more of a loamy character, usually with a larger amount of humus; rich loamy soils occur only in certain limited areas. Black peaty clays occur in valleys or swamps at the higher elevations. (4) *North Central Province*, soil variable, in some places hard and poor; in others it is deep and black, free from stones and easily worked, as at the Maha-illuppalama Cotton Experiment Station, (5) *Jaffna Peninsula*, soil described generally as of a hard clayey nature.

Method of Taking Samples of soil for Analysis.—After clearing the surface of the ground of leaves and twigs at any selected spot, dig a small square hole 18 in. to 2 ft. deep, removing all the soil. Then cut a thin section from top to bottom of one side of the hole, and collect this in a clean basket or sack Repeat this operation in five or six other spots where the soil is uniform in appearance, and thoroughly mix the samples so obtained. From the mixture take sufficient soil to fill a box 6 in. by 4 in. by 4 in., and label the box with the name of the estate or garden. Where the soil varies considerably, separate samples should be taken in the above manner. Particulars as to elevation, rainfall, crop growing or to be grown, and previous manuring (if any) should be sent with each sample.

CHAPTER II.

PLANT LIFE

Most plants consist of *shoot* and *root* systems, the former ascending, seeking the light, bearing branches, leaves, flowers, and fruits; the latter descending and avoiding the light. The part at which the two diverge is popularly known as the "collar." Some plants have one or more of these parts wanting, but it is unnecessary to consider these here.

The roots (descending axis) fix the plant in the soil or substratum; they absorb nutriment in a fluid state from the soil, and in many cases act as reservoirs of food stored for the growth of a succeeding season, e.g., Yams, Carrot, Dahlia and other tuberous-rooted plants. To enable the roots to penetrate the soil without injury, their delicate tips are protected by root-caps. In most plants these are very minute, but in some they are large and plainly seen; in the thick hanging, *aerial roots* of the Screw-pines (Pandanus) the root caps are very large, and can be pulled off by hand. Towards the ends of the roots *root-hairs* are produced; these apply themselves to the particles of the soil, and by means of the acid fluid permeating their thin cell walls, they dissolve ingredients which they absorb and then use in the nourishment of the plant.

The shoot or stem (ascending axis), generally arising above the surface of the ground, exposes the leaves and other appendages to the full influence of light and air, conducts the necessary mineral substances from the roots to the leaves, and also the food supply from the leaves to the roots. Stems are *erect* (as in trees), *climbing*, by hooked spines, tendrils, etc., (as in Calamus and Vines), *twining* (as in Ipomœa), *creeping* (as in Sweet-potato, Pepper, Vanilla, etc.), or *underground* (as in Ginger). Underground stems (known as *rhizomes*) superficially resemble roots, but can be distinguished by their possessing rudiments of shoots and leaves in the form of scales with buds in the axils. Ordinary stems are of two types, *dicotyledon* and *monocotyledon*. The former represent the majority

of trees, shrubs and annual plants, in the stem or shoot of which there is a soft central cylinder of pith, surrounded completely by wood, and external to this by *cortex* and then *bark*. The bark or cortex is separated from the wood by the fibrous layer or *bast*, on the inner side of which is a thin, watery or viscid layer called the *cambium* or formative tissue. In plants of this type which exist for more than two years, new layers of wood and bark are successively formed from the cambium. In the second type of stem (monocotyledon), as occurs in palms, bamboos and grasses, the pith occupies the whole of the stem, the wood and bast being scattered throughout in strands (*vascular bundles*), instead of being continuous and solid; there is no separable bark, that being represented by a hard external layer called the *rind;* in these the stem is hardest externally (whilst in the former type the hardest parts of the stem are internal), there is no cambium, and therefore the stem does not normally increase in thickness.

The leaves are usually composed of a thin layer of green tissue termed the *mesophyll*, which contains the *chlorophyll* bodies or green colouring matter. This is held together by a framework of ribs commonly known as *veins*, or botanically as *vascular bundles*. Each surface is protected by a special layer of cells known as the *epidermis*. In the lower surface of ordinary leaves are microscopic openings, called *stomata*, leading into the substance of the leaf; through these the inhalation and expulsion of air and moisture take place. In a few exceptions the leaves are placed edgewise towards the source of light, as those of Eucalyptus, Loranthus, etc., the stomata in these being equally distributed over both surfaces of the leaf; in floating leaves, as in Water-lily, the stomata are on the upper surface. The functions of leaves may be compared to those of the stomach and lungs of animals.

The roots, stems and leaves being concerned in the supply and elaboration of food, are called *Organs of Nutrition*, whilst the flowers are the *Organs of Reproduction*, producing fruits and seeds.

Flowers.—A typical flower consists of four distinct series or circles of parts, the outer of which, composed of small green, leaf-like organs called *sepals*, forms the *calyx*; the next inwards, a circle of brightly coloured and sometimes scented leaves, called *petals*, forms the *corolla;* when both sepals and petals are similar in appearance and colour, as in Lilies, they are known collectively as the *perianth;* this term is also sometimes used when one of the

circles is absent, as in the Croton flower. The third series, consisting as a rule of a few or many thin stalks, bearing swollen bodies at their tips, are the *stamens* or male organs; the stalks are known as the *filaments*, and the swollen bodies as the *anthers*, which contain the *pollen*. The fourth and innermost circle consists of the *pistil*, the lower inflated part of which is the *ovary*, containing the *ovules*, which when fertilised become the *seeds*. At or near the apex of the pistil is the *stigma*, through which the pollen tubes penetrate to fertilise the ovules. The intervening part, when present, between stigma and ovary is called the *style*. Flowers are *pollinated* when the pollen from the anthers is transmitted, either naturally or artificially, to the stigma. The act of *fertilisation* is brought about by each of the pollen grains developing a tube which grows through the stigma down the style to one of the ovules, when its contents fuse with a special cell of the latter. The functions of the exterior circles, calyx and corolla, may be considered as protective and attractive respectively; while the stamens and ovary are essential for reproduction. These latter may be present in the same flower (*hermaphrodite*), or they may exist in separate flowers (*unisexual*). Flowers which possesses stamens and not a pistil are called *staminate* or *male* flowers; *female* or *pistillate* flowers are those in which the stamens are absent. Some plants bear both kinds of flower on the same individual and are called *monœcious;* others bear them on separate individuals, as the Date palm and Nutmeg tree, and are known as *diœcious*.

Seeds.—Every perfect seed contains an *embryo*, which is the future plant in a rudimentary state. If the shell be taken off a bean seed, for example, the following parts can be easily distinguished. (1) two fleshy bodies placed face to face called *cotyledons* or seed-leaves, known also as "nursing leaves;" (2) a minute projection at their base pointing upwards, called the *plumule* or future shoot; (3) a longer projection, also at their base, but pointing downwards, called the *radicle* or future root. In germination the radicle grows downwards, the *cotyledons* separate, and the plumule develops upwards, the whole seedling living and increasing on the reserve food stored in the nursing leaves until the roots are functionally active, and the young parts and leaves above ground assume their green colour. In other seeds, as cereals, palms, grasses, etc., the embryo is very small, and is surrounded by a mass of tissue (*endosperm*) which may be either of a mealy consistency (as in Maize), oily (as in Hevea), or horny (as in palms). In these cases

the endosperm, and not the cotyledons, provides the requisite nutrition for the young plant.

NUTRITION OF PLANTS

In the youngest stages of its life, as has been shown, the plant is supplied with nourishment from the food stored up in the seed for that purpose. By the time the roots and leaves have been formed, this supply becomes exhausted, and the plant must now obtain its food from the soil and the air. Through their delicate root-hairs the roots absorb from the soil various chemical salts in solution, which are transported upwards through the stem and distributed to the leaves. The acid sap of the root, together with the CO^2 (carbon dioxide) gas, probably assists the moisture in dissolving the mineral matter in the soil. The leaves imbibe from the atmosphere, through their *stomata*, carbon dioxide, the carbon of which enters into combination with the substances absorbed by the roots to form sugar and then starch, and also albumen matter. The process of forming starch by the agency of *chlorophyll* (the green colouring matter in the leaves and green parts of plants) is called *assimilation* or, to use the more modern term, *photosynthesis*. This can only take place under the influences of light and air, the latter supplying the CO^2 and the former the energy by which the carbon is split from it. During sunlight the stomata of the leaves are continually giving off oxygen which has been separated from the CO^2 taken in, the carbon itself being retained by the leaf. In darkness no fixation of carbon can take place, as light is necessary for the splitting of the CO^2, so no starch is formed and at the same time no oxygen is evolved. Consequently the process of respiration, which is always going on, becomes evident through the evolution of CO^2 In sunlight this is masked as the CO^2 formed in the leaf by respiration is immediately concerned in assimilation.

As the saline matter is carried up from the soil through the plant in extreme dilution, the excess of water thus absorbed has to be got rid of in the leaf. This passes out through the stomata in the form of water vapour and the process is known as *transpiration*. It is important therefore to distinguish clearly between the three processes of *assimilation*, *respiration*, and *transpiration*.

Food of plants.—The main elements necessary in the food of plants may be said to be hydrogen, oxygen, carbon, nitrogen, sulphur, phosphorus, potassium, magnesium, calcium and iron.

The supply of the first three elements comes from the air and water, the remainder are taken up in the form of salts from the soil. Nitrogen is of the greatest importance, being an essential constituent of every organic body. It constitutes the chief bulk of our atmosphere, but plants (other than Leguminous species) are unable to assimilate it in a free state, that is, unless it is first chemically combined with another element. Plants most probably absorb their nitrogen from the soil in the form of nitrate or ammonia compound. Besides nitrogen, the other elements likely to be deficient in the soil are phosphorous and potassium. These are often supplied in the form of phosphates and potash salts.

Soil bacteria and Nitrification.—It is now known that the appropriation of nitrogen by plants is due to the agency of bacteria, which exist in all fertile soils. It is considered that the presence of active bacteria in the soil is as necessary to plants as the working of the yeast plant is to the brewer. These microscopic organisms, or ferments as they are called, perform the useful function of converting the nitrogenous organic matter in the soil into *nitrates*, or soluble plant-food. The process is accomplished by the action of two separate groups of bacteria, and is termed *nitrification;* one group of these organisms convert ammonia into *nitrites*, and the other change nitrites into *nitrates*. Although both organisms are always present in fertile soils, the one cannot perform the work of the other. A favourable degree of warmth and moisture are essential to the active operations of these bacteria; at low temperatures their work is retarded, and at a certain degree of coldness it practically ceases. Hence an open porous soil, assisted by good tillage and mulching, encourage their activity and thereby tend to promote oxidation of the organic matter in the soil.

Nitrogen-collecting Bacteria.—It is well-known that on the roots of certain Leguminous plants there usually occur nodules or tubercles, which vary in size from that of a pin's head to a pea. These nodules contain a species of bacteria which abstract and fix the free nitrogen of the air. The nitrogen thus becomes stored up in a combined form in the roots and stems of such Leguminous plants, and when the roots of these are left in the ground, or the whole crop dug in as green-manure, the soil is considerably enriched thereby with nitrogen. Only Leguminous plants (chiefly those of the sub-tribe Papilionaceæ) obtain their nitrogen in this way, all other plants, so far as is known at present, depending for their supply on nitrates formed by the soil bacteria from organic

substances in the soil. This property of Leguminous plants has long been recognised in agriculture, and Leguminous crops are therefore esteemed an important factor in the rotation of crops, and also in what is known as "green-manuring."

Nitro-bacterine, Nitragin, or Bacteria culture.—The nitrogen-gathering bacteria of Leguminosæ have in recent years been isolated, and cultures of them are placed on the market as a commercial product, in different forms known under the names of *nitragin*, *nitro-culture* and *nitro-bacterine*. Certain soils are said to be practically devoid of the right kind of bacteria, and unless some means of introducing the germs be resorted to they will not produce a healthy Leguminous crop. This deficiency is claimed to be met by applying artificial cultures of the necessary organisms, as those named, the principle of their use being much the same as that of mushroom spawn.

Bacteria inoculation.—The means of applying these bacteria cultures is either by inoculating the seed, or the soil into which the latter is to be sown, with water containing the special variety of germ required for the crop. Inoculation of the soil deficient in bacteria was the first method suggested, portions of the soil so treated being afterwards transferred to the larger fields for the purpose of inoculating the latter. This method, however, involves certain disadvantages, viz., excessive cost of transport and labour, and the danger of introducing insect or fungoid pests and objectionable weeds. These difficulties are obviated, it is claimed, by inoculating the seeds, this being effected by thoroughly moistening the latter with a liquid solution of the culture, and then drying them in the shade. So far, however, opinions are divided as to the general merits of bacteria culture and inoculation.

Water in its relation to plant-food.—Water is an essential factor in the life of a plant; it enters very largely in its composition, enabling it to retain rigidity, and carries nutritive substances in solution through the plant's body. Water constitutes by far the greater bulk of fresh vegetable substances (at least 80%), and also forms a large percentage of ordinary cultivated soils. The solution of mineral substances and gases, for absorption by the roots of plants as food, is dependent on the presence of water. When the amount of water at the root is deficient, the plant wilts, and unless a timely supply is restored to the roots the plant withers and dies.

Water differs in several respects according as it is obtained from rain, ponds, streams, springs, or wells. Rain-water is free

from mineral matter, but usually contains a small percentage of ammonia which it obtains from the atmosphere; it also contains carbon dioxide, so that it is able to dissolve carbonate of lime in the soil. Rain-water is thus said to be "soft," and is preferred for watering plants or crops. Spring or well-water usually contains varying quantities of carbonate of lime and other mineral matter, when it is said to be "hard"; in some cases it also contains large quantities of iron oxides, and these form encrustations on bodies placed in the water; this is often characteristic of well-water in the northern part of Ceylon, which consequently is injurious in that condition to plant or animal life. Such water should always be exposed for some time to the sun before use. Running-water also contains in the form of sediment different mineral substances varying in quantity according to the source of the water and the course through which it runs. Irrigation waters in their passage through the soil remove large quantities of nitrogen (in the form of nitrates) and other valuable ingredients from the soil. It has been established by experts that the quantity so removed is in some cases so great that if the water could be supplied to crops in sufficient quantity it would supply the place of manure.

CHAPTER III.

MANURES

The use of manures is, briefly, to supply nutritive matter for encouraging and sustaining plant-growth. They restore the fertility of an exhausted soil, and enrich a naturally poor soil. Any substance, therefore, added to the soil which has the power, either directly or indirectly, of increasing its fertility may be considered as a manure. It may contribute directly by supplying what is required, or indirectly by its chemical action on dormant substances already present, but not in a suitable state for being absorbed by the plants. Manures, more especially farmyard or pen manures, may also improve the physical condition of the soil, rendering heavy clay land lighter and more porous, and sandy soils denser and more retentive of moisture. Growth in plants cannot take place without the main constituent parts of which they are composed being extracted from the earth. The continued production of crops, therefore, necessitates the withdrawal of an enormous supply of certain elements from the soil, and it is evident that if no means be taken to restore the substances thus removed, the soil becomes gradually "exhausted" (see under *Soils*). According to LIEBIG, "the best fertiliser for any particular crop is that which contains the amount of nitrogen, phosphoric acid, potash, etc., which are removed from the soil by a typical good yield of the crop in question."

The immediate effect of a manure depends, (1) on its solubility, and (2) on the suitability of the plant-food which it contains for the use of the crop or plant it is applied to. Suitable mixtures, made up according to the special need of different crops, usually afford most satisfaction. Manures may be divided into two classes, viz.—(1) *Organic* (or *Natural*) *manures*, as those composed of vegetable or animal substances; and (2) *Inorganic*, or *Artificial manures*, which are of mineral origin. While most manures act directly by supplying the three chief elements of plant-food (nitrogen, potash, and phosphoric acid), certain kinds are of value chiefly on account of

their properties of liberating the plant-food in the soil, or of correcting soil acidity, fixing ammonia, or destroying various pests. Such substances are known as *Indirect fertilisers*, and include lime, marl, gypsum, charcoal, etc.

In applying "artificial" manures, it is well to remember that seldom should more than ½ lb. to the square yard be applied at a time; this is equal to over 1 ton to the acre, while 1 lb. to the square yard is over 2 tons 3 cwt. to the acre.

ORGANIC MANURES

Farmyard, or natural manure.—By this is generally understood the manure produced by horses, cows, or other cattle kept on the estate or farm. The excrements of different animals possess special fertilising properties, but for ordinary purposes farmyard manures are best mixed together, both solid and liquid. The liquid portion should be soaked up by the litter, so that the latter may have moisture enough to allow of its decomposition, instead of being left to dry, when it is rendered almost useless. Farmyard manure deteriorates by violent heating, but partial decomposition by slight fermentation before adding to the soil is essential in order to render its constituents more soluble. It is even injurious if applied in a "fresh" state, affecting both crops and the nitrates of the soil. For improving the permanent fertility of soils, farmyard manure is the most important of all fertilisers. In addition to its manurial properties, it has valuable physical effects upon the texture and water-holding powers of the soil, and in dry seasons these may count for more than fertilisers towards ensuring good crops. It restores humus in the soil, gives cohesion to sandy soils, rendering them more retentive of moisture and resistant to drought, and renders clay soils more porous and workable. It may be assumed that a ton of average well-rotted farmyard manure contains 10 to 12 lb. of nitrogen, about the same of potash, and 4 to 6 lb. of phosphates.

Stable, or Horse manure.—This is called a "hot" manure because, owing to its loose texture, it easily undergoes decomposition or fermentation, producing a high degree of heat. On this account it is very liable to lose more or less of its nitrogen in the form of ammonia. It is usually richer than cow manure, but more liable to loss on keeping.

Goats' dung.—This is sometimes procurable in the neighbourhood of cooly lines. It is a good manure, though its action seems

to be comparatively slow. FIRMINGER, in India, stated : "I have often used it for a manure ; but not, as it seems to me, with any marked advantage. Sheep's dung, being similar, would probably give like results."

Poultry dung.—The dung of fowls is somewhat similar to guano, though far less valuable than that material, weight for weight. The difference in quality is largely due to the fact that the food of fowls is very different from the fish diet of the sea-birds which produce guano. Fowl manure usually contains about 2 to 4 per cent. of nitrogen, while good Peruvian guano may contain as much as 20 per cent.

Night-soil.—It has often been stated that there is no manure equal in fertilising value to night-soil. The late DR. BONAVIA, of Lucknow, confirmed this opinion, and found that night-soil produced special "richness of colour in flowers, and vigour and succulence in vegetables." On the Continent of Europe, night-soil is highly valued as a manure.

Poudrette.—In some large European and American towns, night-soil is dried and made into a transportable form which is sold under the name of poudrette ; but as it is prepared by adding largely such materials as gypsum, ashes, earth, sawdust, etc., the mixture is considered to form but a poor fertiliser.

Blood meal.—This is usually considered an excellent manure, being rich in nitrogen (2 to 15%). FIRMINGER, however, in speaking of his experience of it in India, said : "I discovered no advantage whatever in the use of such a manure over that of decayed cowdung, while the unforeseen nuisances attending it determined me never to use it again." BAMBER recommends it in Ceylon as a useful source of nitrogen. Owing to its concentrated form, it is easy of transport where long and difficult journeys are concerned. It may be applied to general crops at the rate of about 200 lb. per acre.

Fish guano.—Fish manures form very valuable fertilisers, containing as they do a high percentage of ammonia, combined with a fair proportion of phosphate. Their decomposition is very rapid, and the quantity applied to the land must be limited owing to their considerable strength. Such manures are more safely used if mixed in a compost of soil and refuse, so that their powerful fertilising properties can be more evenly distributed. In Ceylon, fish guano is used with good effect for coconuts and other cultivations near the sea-coast, being applied at the rate of about 500 lb.

per acre ; it is also largely used in manure mixtures for Tea, on the growth of which it has a marked effect. It should not, however, be applied to soils above any water supply, as by polluting the latter it has been known to be a cause of dysentery, etc.

Bones.—Both for field and garden crops, for fruit and other trees, bones in some form or other are extensively employed as a manure. When used in merely a crushed state their decomposition is slow, consequently their fertilising properties are lasting ; reduced to a powder or meal, and applied as a manure, the results are observable in a much shorter time. The usual commercial forms in which bones are applied to the soil are : $\frac{1}{4}$ inch bones, bone-meal, and bone-dust. Bones are considered to have the best effects on soils that are deficient in lime ; they are commonly used as a manure for rice-fields in Ceylon, and yield good results. Soils rich in decomposing organic matters, such as leaf-moulds, are greatly enhanced in fertility by an application of bone-meal.

Guano.—This valuable manure, obtained principally from islands off the coast of Peru, and various other places on the coast of South America, is usually the excrement of sea-birds. It has been deposited there during the course of centuries and varies in quality, that found in the regions which are liable to heavy rainfall or shifting sands being of least value. The best guano is supposed to be that which comes from Chincha Islands, where the supply is said to have now become greatly diminished. The guanos of commerce may be classified under two heads :—(1) nitrogenous guano, of which the "Peruvian" is a type ; (2) Phosphatic guano, of which the "Bolivian" is an example,—the latter being inferior. The chief fertilising properties of guano having been ascertained by analysis, various artificial manures are now prepared as substitutes for it. Sometimes sulphate of ammonia is added to nitrogenous guano, the mixture being then known as "Fortified Peruvian Guano." Guano should always be mixed with about six times its bulk of fine earth, loam or ashes ; the mixture may be applied at the rate of about 4 or 5 cwt. per acre, according to the nature of the crop. For pot-plants, guano may very advantageously be applied in solution with water, the proportion varying according to the size and variety of plant for which it is required. About 1 oz. to two gallons of water may generally be used with safety.

Leaf-mould.—Leaves, when thoroughly decayed and reduced to a state of mould, form a sort of manure known as leaf-mould.

This contains a considerable proportion of potash and nitrogen, and is a most valuable growing medium, either alone or mixed with other substances, being eminently suited to the growth of most plants. All fallen leaves and vegetable refuse in a garden should therefore be collected and thrown into a deep pit or trench, dug in some obscure corner in order to provide leaf-mould. In dry weather, water should be supplied to the pit, so as to give its contents a thorough soaking, thus hastening decomposition. Leaf-mould is particularly suited for the cultivation of pot-plants, especially palms, ferns, and such fine foliage plants as naturally grow under shade in the jungle. (See under *Soils*).

Castor, Ground-nut, or Poonac-cake, etc.—These are the residue of castor-oil seeds, ground-nuts, coconuts, etc., after the oil has been extracted. They are esteemed as manures, being usually rapid in action, and are somewhat largely used on up-country estates in Ceylon. BAMBER states that castor-cake is "one of the most useful manures for Tea, and an excellent basis for other mixtures, the percentage of nitrogen in the best castor cake being about 6%, though often only 5% in some grades." On all garden crops, and especially Roses, castor-cake is considered to have excellent results. Rape and cotton-seed cake are also valuable manures.

Jadoo, or Jadoo-fibre.—This potting material, or "growing medium" as it is called, has been patented some years ago by COL. THOMPSON, in England. It has for its foundation peat-moss, which is of an exceedingly spongy and absorbing character, not unlike fine coconut fibre in appearance. This is said to be boiled, impregnated with nitrate of potash, bone-meal, gypsum, soot, etc., and then fermented. When the substance is ready for use it is almost free from any smell, and is a clean and light material to handle. It is especially adapted for such plants as are required for growing in-doors. As a propagating medium, especially for germinating seeds, it has been highly spoken of. It used to be imported by a firm in Colombo, but apparently the cost of transport has prevented it becoming popular in the tropics.

Sea-weeds.—Along the Ceylon coasts, and particularly in the north, sea-weeds are frequently used as a manure, being applied in the fresh state, either for digging into the ground or for forming a mulch on the surface. The percentage of nitrogen, potash, and phosphoric acid which sea-weeds contain is, however, considered small, so that their effect on soils is not a lasting one.

Town-sweepings sometimes form a useful manure. Though in some cases they consist largely of sand, in others they contain large quantities of organic matter. The refuse from the neighbourhood of markets are especially useful as a manure, while scrapings from side-drains often contain a large amount of humus and other manurial substances; their liability to contain troublesome weeds is, however, an objection to their use on field crops.

Coir-dust.—This decomposes so slowly that it can hardly be said to be of much value as a fertiliser. It has, however, a beneficial mechanical effect on certain soils, especially such as are deficient in humus. It may with advantage be used to give "body" to potting soils, but it should always be well leached in the open air and rain before use. In the neighbourhood of Colombo and coast towns generally, this is largely employed for pot plants.

Woollen refuse and shoddy.—These are waste materials from woollen and cloth mills, and are used in Europe to some extent in the manufacture of manures. It is said that they usually contain from 5 to 10 per cent. of nitrogen, and that their manurial effects extend over two or three years. The more finely divided the material the more readily it decomposes in the soil, and the more evenly it can be distributed. This form of manure is commonly used in the cultivation of Hops in England.

INORGANIC MANURES

Lime.—Lime is a necessary element of the food of plants, enters into the composition of every form of vegetable life, and few soils that do not contain it in some form. But as a manure in itself, lime rarely needs to be added to the soil; as an indirect fertilising agent, however, it is of the greatest importance. It being necessary for all organic or vegetable matter in the soil to undergo decomposition before the contained elements are rendered available for use as plant-food, lime in its hot or caustic condition is one of the most powerful agents for effecting such decomposition. Thus an application of lime to "acid" or "sour" land, often has most beneficial results; whilst its action on heavy or inert soils is an important aid to fertility, causing the soil to become friable, and thereby giving free access to air and water, which encourage the growth of soil bacteria. It is considered that any soil containing less than ½ per cent. of lime cannot be brought to a high state of fertility. Lime is valuable for pasture land, as well as for field and garden crops, whilst its effect as a preventive against fungoid diseases (e.g., club-root) and insects in the soil is

well-known. The quantity that should be applied varies according to the nature of the soil. In hot countries the soil requires less lime than in cool or temperate regions, owing partly to the more rapid rate of decomposition that naturally takes place in the former. In Ceylon, an application of 2 to 3 cwt. per acre is usually considered sufficient for field crops, and this in the case of Tea is generally applied with buried prunings. For garden purposes 6 to 8 oz. per square yard is a safe dressing. Clay soils require more lime than light loams or sands. In the case of land which contains but little humus, lime should only be applied in very small quantities, otherwise exhaustion of the soil will result. Ground that is frequently manured, as an old vegetable garden, will be much improved by small applications of lime, which act as a corrective of inertness resulting from liberal manuring. Except for such plants as Rhododendrons, for instance, to which it is really injurious, the application of lime to rich garden soils should be attended to every third year or so. It should be remembered that lime will not supply the place of organic manure, that it merely renders this available for the nourishment of plants, and that in some cases its application to the soil may even be injurious. An old maxim of farmers is that—

> Lime and lime without manure,
> Makes both farm and farmer poor.

The exhaustive effect of continued liming of the soil, whilst adding insufficient organic matter to the latter, is also aptly put in the adage,—" Lime pays the father, but ruins the son."

Coral lime, which is almost a pure carbonate of lime, is what is usually employed for manurial purposes in Ceylon. It is imported from India and the Maldive Islands in hard lumps, and is either ground to a fine state and sold as *ground-coral*, or burned in kilns, when it is supplied as burnt or *quick-lime*.

Chalk acts both mechanically and chemically when applied to the soil. It renders soils which are light and incapable of holding sufficient moisture more compact and retentive, a quality which prevents the rain washing away the soluble substances necessary for the support of plant life. Chalk is a variety of carbonate of lime and, in addition to the latter, contains to a varying extent clay, sand, potash, soda, oxide of iron, phosphoric and sulphuric acids.

Gypsum, or Sulphate of lime, is a combination of lime, sulphuric acid and water; it belongs to the class of *indirect manures*, and exists to a large extent in ordinary superphosphates.

Though opinions regarding its fertilising action are divided, its use is often attended with much success. It may be applied at the rate of 3 to 5 cwt. per acre or about 3 oz. per square yard, and is found to produce the best results when used in wet weather. It is considered best adapted to light sandy soils, though it is also sometimes successfully employed on heavy clays.

Ashes.—Wood-ashes contain potash and soda, besides other inorganic elements of plant-food, and therefore form a valuable manure. They are suitable for applying by themselves, or for intermixing with dung or other manures. The charcoal which the ashes usually contain in small pieces has the important property of absorbing ammonia and other gases, and again giving them off for the nourishment of plants. Wood-ashes are on this account valuable as a deodoriser. *Coal-ashes* have useful manurial effects in some cases, especially on stiff clayey soils, owing to the sulphate of lime or gypsum they contain, and have been found to encourage the growth of leguminous vegetables. (See *Peat*, under *Soils*).

Magnesia is essential to the growth of plants, it being always present in their ashes in variable proportions. Applied as a manure, it is considered that it may act directly by serving as food for the plant, or indirectly by uniting with insoluble mineral substances, and rendering these available as plant-food. "Japanese experts show that the ratio of lime to magnesia in soils has an important bearing on many crops." (BAMBER).

Ammonia.—Ammonia is one of the most important components of manures, and one which has a powerful stimulating action on the growth of plants, usually producing a luxuriance of dark green foliage. It is formed by the decay of organic matter in the soil, and also in the air, and is the source from which plants derive their nitrogen. Ammonia is supplied to plants by the decomposition of organic manures capable of forming it, or by the use of some of the salts of ammonia. Of the latter the most commonly employed is—

Sulphate of ammonia.—For garden crops or pot-plants this may be dissolved in water (½ ounce to 1 gallon of water) and applied as a liquid manure, having in this way most beneficial effects on plant growth. BAMBER recommends it as "a very useful ingredient in mixtures, as it supplies soluble nitrogen in a most concentrated form ; the quantity so employed may be from 25 to 50 lbs. or more per acre." This and other salts of ammonia are very powerful in their action, and need to be used with caution.

Nitrate of soda (Chili saltpetre).—Of all the nitrogenous manures, nitrates are the most rapid in action, as the nitrogen they contain is actually in a condition in which the plant can take it up at once without change. Being readily soluble in water, it is easily washed out of the soil by rain or heavy artificial waterings ; it should therefore be applied rather in a dry season and when the plants are well-established and in active growth. Nitrate of soda is obtained from Chili, and is sometimes called *Chili saltpetre*. Owing to its high percentage of nitrogen (about 15%), it has very stimulating effects as a manure, and should be used in small dressings occasionally, rather than in one heavy application. It is readily assimilated by plants, and is considered especially suited for root and grain crops. For garden crops an application of about 1 lb. per 40 square yards, or 1 cwt. per acre, applied as a surface dressing, is considered a sound practice. It is computed that 3 cwt. of nitrate of soda is equal in value as a fertiliser to 80 tons of farm-yard manure.

Calcium nitrate is manufactured in Norway, and is obtained by extreme heat, achieved by means of the electric arc flame, under which atmospheric nitrogen is made to directly combine with oxygen. The chemical combination produces nitric acid gas. The compound is afterwards passed through water and lime, and finally a solid nitrate of lime (calcium nitrate) is obtained.

Potash is found in large quantities in the ash of plants, and is a valuable constituent of manures. It is of special value to starch and sugar producing crops, as potatoes, beet, etc., as also to fruit crops, constituting as it does the principal ingredient in the ash of fruits. Potash is of special importance in the process of assimilation, in which starch is converted into sugar. It is rarely used as a manure by itself, being usually applied in conjunction with nitrogenous or phosphatic fertilisers. Soils which are sandy or gravelly, or have become exhausted from continuous cropping or from lack of manuring, stand most in need of this form of manure. The chief source of potash salts, of various grades, lies in the saline deposits at Strassfurth and other places in Germany.

Nitrate of Potash (sometimes called *Nitre, or Saltpetre*) is a combination of potash and nitric acid. It is a powerful manure, containing both nitrogen and potash, and is especially adapted for fruit production. The frequent use of this is, however, considered to have the effect of exhausting soils of organic matter. It is recommended for forking in among Tea plants at the rate of about 100 lb. per acre.

Sulphate of potash usually contains about 50% of potash, and is considered to be the cheapest and best form of applying potash to the soil. In orchards it may be applied at the rate of about 1 lb. per tree, and to Tea plants about 112 lb. per acre may be given, as with buried prunings.

Kainit.—A compound of sulphate of potash and magnesia, now much used as a potash manure. It is imported from Germany, and usually contains 12 to 14 per cent. of potash, and about 35 per cent. of common salt.

Muriate of potash.—Also a product of German potash mines, said to contain about 50 to 60% of actual potash.

Superphosphate.—This is perhaps the most important and universally used form of phosphatic manures. It is made by treating rock-phosphates, bones, etc., with sulphuric acid, afterwards drying the product. As usually prepared, it should contain about 17% phosphoric acid soluble in water. A form known as "Concentrated Superphosphate" is imported which contains about 44% soluble phosphoric acid.

Basic slag, Basic cinder, or Thomas' phosphate is a by-product obtained in the manufacture of steel. Iron ores contain irregular quantities of phosphorus, and the object of the steel-maker is to get rid of all the phosphorus in the iron. To effect this the iron is melted in contact with limestone, which extracts the phosphorus and forms a slag. This, when ground to a fine powder, forms what is known as *basic slag*, which may vary very considerably in quality, though usually it contains 30% to 40% phosphate. Basic slag has grown in favour as a form of manure in Ceylon, more especially for applying with buried Tea prunings or green-manure; in this way it may be applied at the rate of about 3 to 5 cwt. per acre. For fruit trees, roses, etc., it may be applied with good results at the rate of 4 to 6 oz. per square yard.

Phosphate of lime.—All organic manures, and some kinds of chalk and marl, contain phosphate of lime. This is also found in nearly all plants, and, on account of its supplying phosphoric acid, constitutes a valuable addition to soils. Phosphatic manures are noted for stimulating plants into vigorous growth, thereby rendering them better able to assimilate the potash contained in the soil.

Chilinit is described as a new fertiliser, composed of the fertilising ingredients in the waste from sugar refineries. "Nitrifying bacteria are cultivated in a portion of the molasses, which is

then mixed with lime and sand, and gently dried at a low heat. The product usually contains 3% to 4% nitrogen and 8% to 9% potash."

Calcium Cyanamide, or Nitrolim.—A new nitrogenous fertiliser in the form of fine friable powder, which is prepared from the atmosphere by the aid of a powerful electric furnace, said to be now becoming a rcognised substitute in Europe for nitrate of soda and sulphate of ammonia. The process of manufacture is stated to be "by heating lime and coke to a temperature of 2,500 degrees centigrade in electric furnaces of the resistance type. Calcium carbide is thus produced; the carbide is then heated in retorts, and at 1,100° C., atmospheric nitrogen is introduced and absorbed, the new compound being known as calcium cyanamide or nitrolim. This is usually guaranteed to contain 20% nitrogen. It is said that nitrolim has sometimes an injurious effect on young plants and that, in order to obtain the best results, it should be mixed with nitrate of lime, in the proportion of 2 parts of the former to 1 part of the latter.

Salt (Chloride of sodium).—Common Salt, which contains soda, chlorine, and other substances, has been used for manurial purposes from very early times, and in some countries is still so employed to some extent. Especially for such plants or crops as are indigenous to the sea-side, as Coconuts, Asparagus, Beetroot, etc., salt is considered by some to be very beneficial as a manure. Yet it is a disputed point whether it has any manurial value, direct or indirect, it being often asserted that it has none. The presence of sodium and chlorine in the ash of most plants is considered by some to be due to accident rather than necessity, the quantities present being very variable. Further, it is stated that even were salt a necessary plant-food, its presence in all soils is already sufficiently abundant to obviate any necessity for its application. It is, however, as an *indirect fertiliser* that the beneficial effect, if any, of salt chiefly lies. Dr. Aikman, in his book on "*Manures and Manuring*," remarks that "the action of salt in decomposing the minerals containing lime, magnesia, potash, etc., is similar to the action of lime; it acts upon the double silicates and liberates these necessary plant-foods, also on the phosphoric and silicic acids, which it sets free." As a preventive of rankness of growth, however, the effect of salt is generally admitted. On the other hand it is thought that, having a great affinity for water, the application of salt is of benefit to crops by absorbing moisture from the sub-soil as

well as from the air. Salt is often recommended and used as a manure for Coconuts in Ceylon. Bamber considers its application beneficial in some cases, and recommends it for Coconuts at the rate of 1 lb. per tree. Whatever be the merits of salt as a manure, there seems to be much difficulty in regard to the proper amount to apply. When applied in excess its action is most deleterious, 20% in a soil being considered sufficient to render the latter barren. Thus it was customary in ancient times, after the conquest of a hostile town, to "strew salt on the enemy's fields, for the purpose of rendering them barren and unfertile." Bamber has found on analyses that the Ceylon rainfall yields from 28 to 112 lb. of common salt per acre per annum, according to the amount of rainfall and the proximity to the sea.

LIQUID MANURES

Although this term is generally considered to imply the drainings of dung heaps, stables, etc., yet almost any manure may be applied to the soil in a liquid state. Manure of this description, though most beneficial to vegetable and other crops, should only be used when the plants are in a healthy state of growth. It can also be profitably applied to composts, so as to induce a more rapid fermentation of their organic matter. It is claimed that liquid manure has a great advantage over solid, being stronger, quicker of action, and capable of being more evenly diffused over the land. Most of the highly concentrated artificial manures are doubtless best applied in solution, but this is not always practicable. Liquid manure may be made by adding a small portion of some concentrated fertiliser to a can of water, and applied at once to the plants it is intended to stimulate. This is a ready and clean method of preparing it, but one which requires some caution in guarding against the dose being too strong. All chemical manures intended for use when dissolved in water should be tried first in a weak solution, and the strength increased gradually if results warrant it. Liquid manures, as already stated, are most effectually employed when the plants are in an active state, yet in want of a stimulant for assisting the development of their crops, or for sustaining their growth.

Soot or Soot-water.—Soot is seldom obtainable in the tropics, except perhaps at some Up-country bungalows. In countries where it is available, it is considered a valuable manure, as well as an insecticide, being used either in a dry state mixed with other manurial substances, or dissolved in water, the latter

form being generally preferable. Soot-water is made by placing the soot in a canvas bag, along with a stone to sink it while dry, in a cask or tub of water: about ½ bushel of soot to 10 gallons of water is sufficiently strong. As the liquid is taken out, more water is added until the virtues of the soot are exhausted. It is claimed that the application of soot-water to the soil in which pot-plants grow increases the size and deepens the colour of flowers and foliage, and enhances the general vigour of the plants. On cold soils especially it is considered useful, as the dark colour of the soot favours the absorption of heat from the sun, and thus tends to the production of earlier crops. A ton of average chimney soot in England contains about 3 lb. of nitrogen, 15 lb. of potash, and 17 lb. of phosphoric acid. Apart from its manurial properties, soot is said to materially assist in keeping down the larvæ of destructive insects.

Soap-suds.—"These," said DR. LINDLEY, "have an undoubted value, because of their potash, irrespective of the organic matter they contain." For potted plants, an occasional application of soap-suds is considered very beneficial. FIRMINGER, in India, said: "I scarcely know of a better and more effective insecticide. By syringing and washing the leaves of potted plants with soap-suds, I have preserved them from the attack of blight, mealy-bug, and other enemies of the gardener. Plants in a sickly condition have often been restored to health by merely washing their leaves with soap-suds. In fact if you wish to keep your plants in a luxuriant growth, wash and syringe them with soap-suds once or twice a week, especially those exposed to dust." PROFESSOR DUNSTAN points out that the above quotation from LINDLEY refers to *soft*-soap, since *hard*-soap contains soda, but no potash.

COMPOSTS AND MIXTURES

Any mixture of different soils or manures, made up in varying proportions, either for potting plants or applying to field or garden crops, may be called a compost. Whilst manure mixtures are important in agriculture, soil composts are equally indispensable in horticulture. The combined effects of a suitable mixture are much more marked, and the application more economical, than if the different ingredients were applied separately. Some manures, natural or artificial, of which only small quantities are necessary, are best mixed with other substances in order to ensure their even distribution; others, again, (e.g., guano) are so powerful that, in an unmixed state, instead of proving beneficial, they would actually be

injurious to plants; all such are, therefore, best applied as mixtures. For potting plants, valuable composts are prepared by mixing loam or ordinary soil, leaf-mould, well-decomposed manures, and a small proportion of fine sand and charcoal; the proportions used should vary according to the nature of the plants for which they are intended and the texture of the ingredients. While many artificial fertilisers may be mixed together with advantage, certain others are quite unsuited for combination. Thus, kainit may be mixed with basic slag, sulphate of ammonia with superphosphate, but neither of the latter should be mixed with basic slag, nor superphosphate with nitrate of soda. Neither should sulphate of ammonia come in contact with lime.

THREE GUIDING PRINCIPLES IN MANURING

Professors Wilfarth and Wimmer have found that the appearance of plants will sometimes afford an indication of what food they are most in need of. Thus:—

Nitrogen.—When the plants want nitrogen the leaves are said to lose their normal green colour, and take on a clear green or a yellowish tint, and to dry finally with a clear brownish-yellow colour. Nitrate increases the colour and vigour of foliage. So powerful is this influence, that the energies of a fruit-bearing plant may be diverted to the production of foliage by too liberal an application of nitrate.

Phosphoric acid.—When phosphoric acid is deficient, the leaves become a deep clear green, almost blue-green colour. With a greater scarcity there appear on the leaves (first at the margin and later on the whole leaf) dark-spots, and the leaf dries with a dark-brown to a black-green colour. Phosphates promote fruitfulness and early ripening of fruit crops.

Potash.—A scarcity of potash is said to be coincident with spotted leaves, the spots appearing in the margin, and later becoming distributed over the whole leaf, the stalk, mid-rib and veins retaining their green colour. The leaf also curves or curls with its convex side upwards, and finally dries up. Potash also improves the quality of fruits and flowers, increasing the sugar contents of the former, and the scent and quantity of the latter.

CHAPTER IV.

GREEN MANURING, MULCHING, INTER-CROPPING, &c.

Green manuring consists in growing special crops, either alone or intermixed with others, for the purpose of digging or ploughing into the soil in a green state, when they have reached a suitable height, or before flowering. This mode of enriching the soil is considered to be one of the most economical as well as efficacious, the fresh vegetable matter being returned to the soil with greater benefit, than when it has been decomposed and much of its goodness has been lost in the process of rotting and fermentation. For improving the condition of light sandy soils especially, green-manuring is of the greatest value. Briefly, the following are the principal benefits derived from the application of green-manures or cover-crops, viz :—

(1) The addition of humus or vegetable matter to the soil, which increases its capacity for retaining moisture.

(2) The prevention of surface-wash on steep land.

(3) The improvement of the mechanical condition of the soil by the action of the roots of the green-manure plants or cover crops.

(4) The protection of the soil and roots of crops from the excessive heat of the sun.

(5) The suppression or diminution of weeds, and therefore economy of labour.

(6) The decomposition of the vegetable matter gives rise to acids, which act as solvents on the soil constituents, thus rendering available more material for plant nutrition.

(7) The fixation of atmospheric nitrogen in the soil by leguminous plants, especially those of the sub-order Papilionaceæ.

Whilst all plants, weeds included, are useful for adding organic matter to the soil, when dug into it in a green state, yet all are not

equally valuable. However well the first six of the objects above named may be achieved by the use of non-leguminous plants as green-manure, it is generally believed that only leguminous species have the power of utilising free nitrogen, which they effect through the agency of the bacteria nodules on their roots. (*See Chapter II*).

In selecting plants suitable for green-manuring, those which are more or less of a herbaceous character and rapid growth, capable of forming a good cover on the ground in a short space of time should be chosen. Creepers or climbers are not usually so suitable as bushy herbaceous annuals, and, if used, care must be taken that they do not twine round the stems of the growing crop. The following are recommended for the purpose, all belonging to the family of Leguminosae :—

Aeschynomene indica. "Diya-siyambala," *S.* Annual, 1-2 ft. high, found in moist places, dry region.

Alyssicarpus vaginalis. "Aswenna," *S.* 2-3 ft. high. Dry Low-country.

Arachis hypogoea. Ground-nut. Herb, 12-16 in. high. Sea-level to 2,000 ft.

Cajanus indicus. Pigeon-pea, or "Dhall"; "Rata-tora," *S.*—Shrub. Sea-level to 2,000 ft.

Canavallia ensiformis. "Wal-awara," *S.* "Koli-avarai," *T.*—Perennial twiner. Low-country.

C.—obtusifolia. "Mudu-awara," *S.* Creeper. Sea-side.

Cassia mimosoides. "Bin-siyambala," *S.* An annual, 2-3 ft. high, common in Low-country; leaves sensitive. Thrives up to 3,000 ft.

Cicer arietinum. Chick-pea; "Kadala," *S.* Annual herb, 1 ft. high.

***Crotalaria juncea.** Sun-hemp. "Hana," *S.* An erect annual. Semi-dry, Low-country.

C.—retusa. "Kilu-kiluppai," *T.* "Kaka-andanahiriya," *S.* Low-country shrub.

C.—striata. A herbaceous shrub, 2-3 ft. high. Low-country, up to 3,000 ft.

C.—Walkeri. (=C.—semperflorens). Perennial herb, 2-3 ft. Montane zone.

Desmodium Wightii. A tall herb, 2-3 ft. high. Low-country.

†**Dolichos biflorus.** Horse-gram; "Kollu," *S.* Small close-growing climber.

D.—Lablab. "Dambala," *S.* Low climber or creeper.

Glycine hispida. Soya Bean. Leafy herb, 1-2 ft or more. Thrives up to 2,500 ft.

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* Sow at the rate of 2 lb. per acre in rows. † Sow at the rate of about 12 to 15 lb. per acre, broadcast.

S=Sinhalese; *T*=Tamil.

Indigofera aspolathoides. "Sivanaivembu," *T.* Rata-kohomba," *S.* Dry region.

I—tinctoria. Indigo. "Nil-awara," *S.* A low shrub, common in the Low-country.

I.—viscosa. Annual, 2-3 ft. high, common in dry region.

Mucuna utilis. Velvet-bean. Climber or creeper. Thrives in Low-country and up to 3,000 ft.

M.—pruriens. "Achariya-pala," *S.*—Annual twiner. Dry and intermediate regions.

Phaseolus lunatus. "Bonchi," or "Dambala," *S.* Herbaceous twiner. Thrives up to 3,000 ft.

P.—semierectus. An erect annual, 2-3 ft. Low-country.

P.—trinervis. Jerusalem Pea. Semi-creeper, about 2 ft. high, quick and close grower. Up to about 3,000 ft.

Psoralea corylifolia. "Bodi," *S.* "Kavoti," *T.* Annual, 1-3 ft. dry region.

Sesbania aculeata. "Dhaincha," *S.* Annual, 1-3 ft. Low-country, including dry region.

Tephrosia purpurea. "Kavalai," *T.* "Pila," *S.* Perennial herb, 1-2 ft. Low-country.

T.—candida. "Boga-medelloa." Shrubby perennial, 4-7 ft. high. Soft pubescent leaves; white fl's. Up to about 3,000 ft.

Trifolium alexandrinum. Berseem, or Egyptian clover. Much esteemed in Egypt as a soil renovator and forage crop, especially on marshy land.

Vigna Catiang. Gas Mê, *S.* Cow-pea.—Perennial twining herb. Low-country.

LEGUMINOUS TREES SUITABLE FOR LOPPING FOR GREEN MANURE, OR FOR PROVIDING LIGHT SHADE

Acacia decurrens. Tan-wattle. }—Quick-growing trees;
Acrocarpus fraxinifolius. } 3,000 to 6,000 ft.

Adenanthera pavonina. "Madatiya," *S.* A tall tree of the Low-country.

Albizzia moluccana. } Large fast-growing trees. Thrive up to
A.—stipulata. } 4,000 ft.

Erythrina lithosperma.—Dadap. Fast-growing, sappy tree. Low-country, to 3,000.

E.—umbrosa. "Bois Immortelle." Quick-grower; thrives best at 1,000 to 3000 ft.

Pongamia glabra. "Punku," *T.* "Magul-karanda," *S.* Large tree of the Low-country.

Tamarindus indicus. Tamarind. "Siyambala," *S.* Large slow-growing tree. Suited to dry region.

S=SINHALESE; *T*=TAMIL

MULCHING OR SURFACE-DRESSING

The practice of mulching or surface-dressing is of very considerable benefit to crops, and during dry weather its adoption is especially to be recommended. Mulching will prevent the surface soil from forming a hardened crust, and thus retard the evaporation of moisture; it provides humus in the soil, and in many cases economises labour by checking weeds and doing away with the necessity for frequent watering. The mulch may consist of green vegetable matter or leaves, stable litter or other refuse, which may be spread over the surface of the ground, and either lightly forked into the soil or merely left on the surface as a protective covering. Leaves obtained from the jungle, or any rapidly decaying organic matter that may be available will answer the purpose of a mulch or surface-covering, but certain plants contain a larger proportion of nitrogen than others; these afford the best mulch and may be grown as cover-crops. The following are some of the principal plants whose leaves or young twigs are commonly used for mulching in Ceylon.

FOR THE LOW-COUNTRY, INCLUDING THE DRY REGION:—

Adhatoda vasica. "Adathodai," *T.*—Shrub, 4 to 6 ft.

Azadirachta indica. Margosa; "Kohamba," *S.*—Small tree; leaves used as mulch in Tobacco cultivation.

Calotropis gigantea. "Wara," *S.* Large, quick-growing shrub.

Cassia auriculata. "Ranawara," *S.* "Avari," *T.* (Leguminosæ).—A sea-coast annual.

Coconut husks. Used largely on, and in the neighbourhood of, Coconut plantations. (See under *Coconuts*).

Croton lacciferum. "Keppettiya," *S.*—A small tree, the leaves of which are commonly used as a mulch in Betel cultivation.

Erythrina lithosperma. "Dadap," (Leguminosæ). (See under *Green Manure*.)

Ricinus communis. Castor-oil plant. A quick-growing, tall annual, naturalised in Ceylon along river banks, etc.

Tabernaemontana dichotoma. "Divi-kaduru," *S.*—A small tree; leaves used for mulching in low-country.

Tamarindus indica. Tamarind (Leguminosæ). A large tree, leaves commonly used for surface-dressing for Tobacco in dry region.

Tephrosia candida. Boga-medelloa. Shrubby perennial, 4 to 7 ft. high. (See under *Green-Manuring*).

S=Sinhalese; *T*=Tamil

Tephrosia purpurea. "Kavalai." *T.* (Leguminosæ). Commonly employed as a mulch in the dry region.

Thalassia Hemprichii. Sea-weed. "Chatalai" or "Sathalai," *T.*—Commonly used in Ceylon for coconut and rice plantations near the coast.

Thespesia populnea. "Suriya."—A medium-sized tree.

FOR UP-COUNTRY:—

See under "*Green Manuring*," also "*Shade trees for Crops*."

INTER-CROPS AND CATCH-CROPS

The growing of two or more crops together on the same land has many advantages over the exclusive cultivation of single products, and though for economic reasons the latter system is usually adopted, it obviously lends itself to the rapid spread of pests or diseases. Plants in their natural state, where numerous species and families are found growing together, are not nearly so subject to such enemies as are large areas of single products.

Advantages of subsidiary crops.—The main advantages claimed for inter-and catch-crops may be briefly stated thus:—(1) check on the spread of plant pests and diseases; (2) revenue may be obtained at more frequent intervals or in the interim of waiting for a crop which takes several years to come into bearing—e.g., Rubber and Coconuts; (3) the soil conditions may be improved; (4) weeds are kept in check; (5) mixed products have usually a longer life; and (6) it obviates the unwisdom of having all one's eggs in one basket.

Disadvantages.—On the other hand, the system of inter-cropping may have serious disadvantages under certain circumstances, as when the proper combination of products are not chosen In this case the soil may become unduly exhausted, the inter-crop or catch-crop may retard the growth of the principal crop, and the proper attention of the management and labour force may be diverted from the latter. It must be admitted, however, that with suitable distance-planting, many of these disadvantages may be overcome.

Mr. Herbert Wright estimates that about 100,000 acres of Hevea rubber in Ceylon are mixed with Tea at low and medium elevations and with Cocoa at medium elevations. In Sumatra, few estates are planted with Hevea alone, while in Malaya and Java also a considerable proportion of the Hevea plantations are inter-planted with other crops.

The following are some of the crops most adapted for inter-cropping or catch-cropping. The difference between the two classes, it may be mentioned, is that the former are generally of a perennial nature, while the latter are annuals or crops of short duration, yielding moderately quick returns.

Inter-crops :—

Tea with Hevea rubber (the latter at the rate of about 25 trees to the acre) at low elevations.

Cacao with Hevea rubber (the latter about 50 × 30 feet.)

Cocao with Coconuts.

Coca with Hevea rubber.

Coconuts and Hevea rubber are sometimes planted in alternate rows.

Pepper as a creeper on shade trees, among Tea or other crops or along roadsides, etc.

Vanilla as a creeper on shade trees, among Tea or other crops or along roadside, etc.

Ipecacuanha (perennial), grown as inter-crop with Rubber, etc., in Brazil, also in Malaya to some extent.

Rubber or Coconuts planted at wide distances apart among Citronella or Lemon grasses.

Catch-crops : –

Cotton.
Cassava (Tapioca).
Chillies.
Bananas
Groundnuts
Arrowroot
} Sometimes grown as an annual crop between the rows of Hevea or Manihot rubber for the first few years.

Tobacco is grown on young rubber clearings in Sumatra.

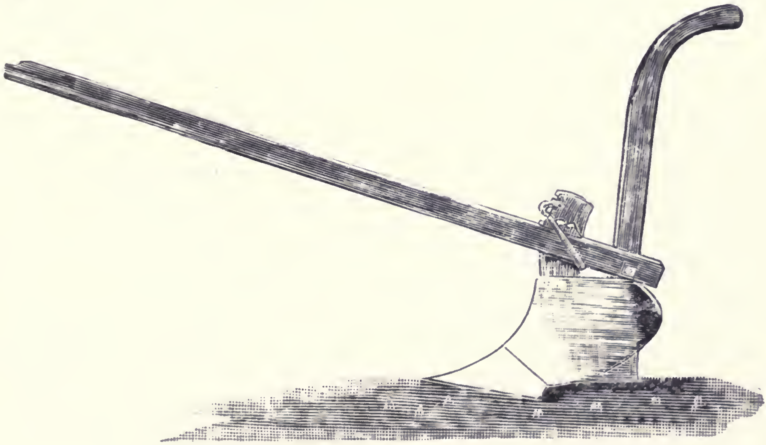
Coffee (especially C. robusta), much grown as a catch-crop with Rubber in Java.

CHAPTER V.

SOIL OPERATIONS

Tillage.—The main objects of tillage, whether in the form of digging, ploughing, or otherwise are:—to loosen the soil so as to facilitate the absorption of rain and the admission of fresh air, and to enable the roots of plants to penetrate the soil more easily. Further, tillage should aim at maintaining a proper supply of moisture in the soil, rendering the latter permeable to rain, encouraging the activity of soil bacteria, and generally suppressing the growth of weeds. Therefore, thorough tillage is often as essential as manuring, especially for root-crops. Plants can only obtain the full benefit of manures when the land is maintained in a proper state of tilth. DEHERAIN conducted experiments which showed that "trituration or pounding of the soil is a powerful method of causing active nitrification." According to an old adage,

"Tillage hinders 'vaporation
Tillage works weed 'radication.
Tillage helps food 'laboration."



A SINHALESE PLOUGH.

Modes of Tillage.—The different methods employed for tilling the land vary considerably in different countries, according to the means available, though the principle underlying all is the same. From the wooden spikes or flint spears which in early times served the purpose of stirring the soil, as they do even at the present day in some primitive countries, to the modern steam plough used on large farms is a great stride in evolution. Digging

BUFFALOES PLOUGHING RICE FIELD

by means of spade, fork, or mammoty (the latter implement being that which is commonly used in Eastern tropics), is adapted to certain confined areas, as gardens, etc., but ploughing, followed by harrowing or similar means of levelling the surface, is the most economical and practical method for preparing the ground for general field crops. Ploughing as carried out in Ceylon, India, Malaya, etc., with buffaloes or oxen as draught animals, is usually performed in a very primitive fashion, the object being to stir up or fork the soil rather than turn it over as a furrow. In some districts in Ceylon, the ground is only puddled or churned by means of wading buffaloes or bullocks, the land being first softened by being flooded with water. The type of plough generally used by

the natives of Ceylon, India, etc., consists of a simple wooden implement with a small iron pointed socket for a coulter. The whole plough, in some cases, weighs but a few pounds, so that a cooly can readily sling it on his shoulders and carry it wherever desired. Heavier and more substantial ploughs have from time to time been introduced, but so far the natives prefer their own primitive article as being more suited to their requirements.

SOIL ÆRATOR.

Use of explosives in Tilling.—As a means of breaking up hard impervious soil or sub-soil, more especially in the preparation of large holes for planting trees, the practice of exploding dynamite charges buried in the soil has recently been much advocated and appears to be generally attended with beneficial results. The immediate effect is to break up the soil in a way which cannot be achieved by deep ploughing or trenching. A hard and impervious sub-stratum may thus be made penetrable to the roots of plants or crops, allowing of the free percolation of water through it and liberating, in many cases, essential elements of plant food. For ordinary sub-soiling, a 2 oz. cartridge to each hole (costing about 4*d.* or 25 cts. of a rupee) is sufficient. More powerful charges of 3 or 4 cartridges may be used for blowing up tree stumps or breaking obstructive boulders, but in this case the operator must seek protection behind a tree or other object.

The method adopted in using dynamite for purposes of holing is described as follows:—

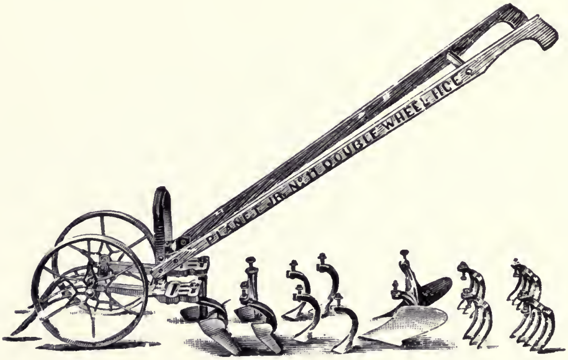
> A hole is bored with a crowbar where planting is to be done, about 2½ feet or more in depth. At the bottom of the hole is placed the cartridge of dynamite, provided with a detonator and fuse. Then the hole is filled with moist earth and beaten down gently. On exploding the cartridge, the surface of the earth will be seen to rise a few inches and subside, and after a few minutes smoke follows from the cracks in the earth. On removing the earth loosened by the explosion, it will be found that a round hole has formed at the point where the cartridge was laid, with innumerable fissures extending for a few feet into the surrounding soil.

Fallowing.—In the case of crops that are of short duration in the soil, fallowing is sometimes adopted for restoring fertility to the

land, after the crop has been harvested. The cropping being stopped, a rest is provided for the soil, during which a new supply of plant-food becomes stored up, and this becomes available for the succeeding crop. For the more permanent crops, however, such as Tea, Cocoa, Coconuts, and Rubber, fallowing cannot obviously be adopted, and manuring and tillage operations must then be relied upon to meet the requirements of the crops grown. Leaving the ground fallow for a certain period has also the beneficial effect of ridding the soil of fungi or insects pests.

ROTATION OF CROPS

Plants differ, as shown by their ash, in the relative proportions of plant-food they require and obtain from the soil. Therefore when successive crops of one kind are grown on the same ground, those elements which are most consumed obviously become exhausted. Consequently the soil becomes "poor" or unproductive, the crop weak and sickly, and even the application of costly manures does not satisfactorily restore fertility. The principle of cropping by rotation is to avoid this, by preventing two crops of the same kind succeeding each other. The advantage of the system is undoubted, and in some temperate countries its



PLANET JUNIOR CULTIVATOR.

adoption is usually made a compulsory rule in the farmer's lease. In the tropics, however, rotation is often impracticable, owing to the fact that many of the crops grown are of a perennial nature and, once planted, last from a few to a great many years. But wherever possible, as in the case of garden or annual crops (root-crops, grains, pineapples, and vegetables) as well as flowering-plants, the

principle of alternating crops should be practised. The question of a practical system of rotation to replace the wasteful method of chena cultivation in Ceylon (by which virgin land is cleared, cultivated for a season or two and then abandoned for a number of years) has yet to be satisfactorily solved. Rotation of a kind is sometimes applied to rice cultivation in the tropics, though seldom in Ceylon. Rotation also exerts a beneficial mechanical effect on the soil, owing to the more or less different mode of preparation of the land required for different products, as well as by the quantity of roots, etc., left in the ground by successive crops. Certain roots penetrate the ground deeper than others; these aerate the subsoil and, when the crop is removed, remain in the ground to rot. Proper rotation is also claimed to be an excellent preventive against fungoid diseases and insect pests, these dying of starvation when a crop intervenes that on which they live or feed. Weeds, too, are checked (sometimes exterminated) by means of crop rotation. It will generally be noticed that when plants of one kind are growing together in great numbers and for many succeeding years, they are liable to be attacked by insect pests and fungoid diseases. Any system of rotation adopted must, of course, vary according to the variety of crops that are desirable to grow; thus different systems are used in different countries. Dr. Willis recommended the following system for chena lands in Ceylon:—

First Year.—Tobacco, Indian-corn or Maize, Cotton, Citronella or Lemon grass (these last may be left on for about three years); all fairly exhausting crops. Pen cattle on the land between crops, and dig in green-manures, e.g., Pila leaves, etc.

Second Year.—Root crops, e.g., Cassava, Sweet-Potatoes, Yams, Arrowroot, Onions, Ginger, Turmeric, etc., Pen cattle, etc.

Third Year.—Dry grains e.g. (Kurrakan), Chillies, Gingelly, Gourds, small fruits, Castor-oil plants, grasses for fodder, Mustard, Murunga. Pen cattle, etc.

Fourth Year.—Gram, Ground-nuts, Peas or Dhal, or other leguminous crop to enrich the soil in nitrogen.

Fifth Year.—As first year, and so on.

For Tobacco land, Mr. C. Drieberg recommends a 3-course rotation, thus:—(1) Tobacco, (2) Leguminous crop, e.g., beans, grams, ground-nuts etc. (3) Grain-crop, e.g., paddy, kurrakan, amu, maize, etc.

For gardens, the following rotation is recommended:—(1) Cabbage, (2) Carrots or Beet, (3) Peas, (4) Celery, (5) Potatoes.

IRRIGATION.

Irrigation is practised chiefly in dry countries, where, in many cases, the cultivation of crops is entirely dependent upon it, as in the northern part of Ceylon. In a moist climate, as in the south-west of Ceylon, irrigation is adopted only in the cultivation of Rice or other water-plants. In countries where the rainfall is limited, however, intermittent irrigation is applied with good results in the cultivation of fruits and other crops. The methods of accomplishing irrigation depends upon the facilities which the situation offers, the water being conveyed from natural sources or artificial reservoirs to the land by means of canals, streams (called "ellas" in Ceylon), pipes, or spouts. In parts of India and in the Jaffna district in Ceylon, irrigation water is hauled up from deeply sunk wells by means of rope and pulley with buckets, and distributed along diverging and transverse channels. A general mode of raising water in parts of India is by means of a large bag made of bullock-hide; the bag is suspended from a pulley over the well, and this is drawn up by a pair of bullocks as they are made to run down a declivity. The "Persian wheel" method of raising water is commonly adopted in Northern India. This consists of a large vertical wheel, fixed in the mouth of a well; over it a looped chain of earthenware pots is suspended, the lower part of which reaches the water. As the wheel revolves, one length of the chain is continually rising with pots of water, which discharge themselves into a trough fixed at the summit, and return empty to be filled again. By means of a horizontal wheel and a beam, bullocks are made to work the apparatus. Wind-mills also are sometimes employed very successfully for raising water from wells.

Different systems of irrigation are adapted for different countries, according to circumstances. A simple system is to conduct water through the land by small canals, the soil obtaining its supply by the water percolating through the porous earth. The "catch-work" method of irrigation is adapted for sloping land, and consists of a series of transverse trenches or channels; the water is conducted through the upper trench, runs along the surface and escapes through regular outlets into the next trench, and thence to the one below, and so on. Similar to this is the "terracing system," which is carried out extensively in rice cultivation on the hill-sides in Ceylon, where it forms a striking feature in the landscape. (See under *Rice*). Artesian wells and tube-wells are largely used in some countries, being especially suitable where the soil is loose

and sandy. They are successfully employed in parts of India, but are not adapted to localities where the soil is of a clayey or hard laterite nature.

In some countries where large rivers run through low-lying land, as in the case of the Nile in Egypt and the Ganges in India, the river itself is allowed to run over the land when in flood and full of rich mud. The latter is thus deposited, as the water subsides, on the land, which is thus enormously increased in fertility. Sir W. Willcocks considers that one good deposit of slime or mud, brought down by the Nile from the detritus of volcanic rocks, could produce six excellent crops in succession. With the extensive irrigation works which have now been made in the countries named, irrigation becomes less dependent upon the fluctuating rises of the great rivers. Some of the larger irrigation tanks in Ceylon, for example, have an area of over 4,200 acres, and resemble large and beautiful lakes. An important principle of irrigation is that the water supplied must neither be excessive, nor allowed to remain on the land so as to become stagnant. Therefore provision must always be made for overflow and the free movement of the water.

DRY FARMING

The term "dry farming" is applied to a system of cultivation adopted for lands in dry districts, the principle being to conserve moisture in the soil, or to increase the capacity of the latter to store water, mainly by the following means:—

(*a*) Deep and thorough preparatory tillage; (*b*) packing the soil by a "sub-soil packer" and heavy rolling. A sub-soil packer is an implement, the object of which is to press the soil under the surface, while the surface-soil is left in a loose condition.

Supplementary to these operations are also measures which secure good intertillage, comparatively thin seeding and wider spacing, thus admitting of perfect development of the plants. In the case of grain crops, the seed should be moistened before sowing so as to assist germination, while planting should be followed by thoroughly pressing the soil round the plants. By observing these rules, good crops are now said to be obtained in parts of India where the annual rainfall is only about 15 inches.

DRAINAGE

Proper drainage, whether natural or artificial, is essential to all cultivated soils. The objects of drainage are, briefly, to enable the rain to become absorbed by the soil and pass through it; to

render the soil porous, though maintaining a sufficiency of moisture for plant-life; to remove superfluous water and prevent stagnant water remaining in the soil. A porous soil contains small spaces between its particles, and these, when not occupied by water, are filled with air, which conduces to bacterial activity and nitrification and is essential to plant-growth. Some lands are naturally well-drained, which may be seen from the fact that when rain falls on them it percolates through without leaving the soil sodden or saturated. Soils which are not properly drained become impregnated with acids which are injurious to plant-life; in such cases the soil is cold, and causes the roots to rot off from the ends, the plants under such conditions being sometimes referred to as suffering from "wet feet." A damp soil is always colder than a porous one, for the reason that water is colder than air.

Surface drainage, i.e., open trenches or ditches at certain intervals, are essential on steep lands, so as to prevent or check the washing away of the surface soil by torrential rains. This system of drainage is extensively employed throughout the Tea-planting districts, and is indispensable to the preservation of the soil. The drains are usually about 2 to 3 ft. in depth, and vary in the distance apart according to the gradient and physical characteristics of the land. On very steep land such drains should not be more than 25 to 30 ft. apart, while on gentle slopes they may be as many yards distant.

In gardens or ornamental grounds, however, open drains would be unsightly if not impracticable, and for that reason they should be covered, notwithstanding the extra cost thus incurred. In making a covered drain, drainage tiles or stones should be placed in the bottom of the trench, large spaces and crevices being left in the bottom, and finishing with a layer of smaller pieces at the top. Brushwood, fibre, or straw may be placed over this, and the soil then filled in. (See *Drains and Culverts*).

CHAPTER VI.

PROPAGATION

Plants are propagated in various ways ; some which increase at a rapid rate by one method cannot be similarly raised by another, while in some cases all methods of propagation fail. The following are the principal modes of propagation in use :—

Propagation by Seed.—This is the most natural mode of increase, and is the one by which the vast majority of plants naturally spread and produce their species, the off-spring being more or less true according as the flowers are disposed to become influenced by foreign pollen affecting their fertilisation. The production of seed may be said to be the aim of the life of every plant in a state of nature. Where exact counterparts of plants cannot be ensured by raising from seed, propagation by vegetative means, as by cuttings, buds, grafts, etc., may be resorted to.

Selection and Saving of Seed.—In the raising of seed of most kinds, it is important that selected plants or trees should be set apart for the purpose and cultivated with special care, so as to encourage the production of perfect and well-nourished seed. The seed from each plant should be sown separately, each batch of seedlings transplanted into a separate plot, and the crop measured or weighed. In this way the parental plants are tested by their performance. It is, however, also advisable where practicable to select individual seeds. Inferior or unproductive plants should be eliminated, and imperfectly formed flowers or fruits removed where possible. Vigour may also be concentrated in the seed by thinning out the flowers or fruits, retaining only the best. This not only applies to annuals which may be grown for ornament or use, but also to fruit-trees, Tea, Coconuts, Cacao, Cotton, Rubber, or other products. It is of importance that seeds should be perfectly ripe before they are gathered, as otherwise their germination and the vitality of the seedling will be affected. Change of seed from one district to another has often a beneficial result, and the practice is generally approved by the best agriculturists and horticulturists. (See under *Plant Breeding* at end of Chapter).

Vitality of Seeds.—It may be assumed that most seeds germinate best if sown as soon as ripe. Although many seeds, if carefully stored, retain their vitality for many years (as palms), they decline appreciably in vigour with age, and the progeny of old seed is generally less robust than that from seed recently harvested. In the case of plants of the Gourd family, however, old seed is sometimes preferred, as this is considered to yield plants of a more fruitful and less leafy nature. Ceara rubber seeds, too, are generally supposed to germinate better when at least a year or two old (See under *Testing Vitality of Seeds*).

Sowing Seed.—Seeds vary in size and character so much that no hard and fast rule can be laid down for sowing. Certain conditions are, however, essential in all cases. All seeds are best sown in fine, light soil, easily permeable to the young roots as well as to the plumule. The surface soil should be made moderately firm and even ; this will ensure the seeds being sown at a uniform depth, and aid in maintaining a moist surface. The proper amount of soil for covering the seeds varies according to the size of the latter. A good general rule is to cover seeds to a depth equal to their smallest diameter. Large seeds should not be buried much below the surface, whilst small seeds may as a rule be covered one-tenth of an inch. Seeds sown in the field, plot, or nursery-bed require to be buried deeper than is necessary for germination, so as to protect them from vermin, etc., and to allow for wash by rains. Seeds which take long to germinate, as Nutmeg, Palms, etc., should be sown about an inch below the surface. In all cases of garden or field crops, the seeds should, whenever practicable, be sown in rows, never broadcast if avoidable. Sowing in rows economises seed, and enables the seedlings being better attended to in regard to weeding, thinning out, etc.

Sowing at stake, which is sometimes adopted in the case of field crops, as Rubber, Tea, etc., consists in sowing the seeds in the position which the plants are to occupy when grown up ; thus holes are prepared in lines and filled in, the position being marked by placing the stake (already used for lining) in the centre ; one to three seeds are sown close to the stake, the weaker seedlings being afterwards removed as required.

In sowing very small seeds, as those of some annuals and vegetables, one is very liable to sow too thickly. A good plan is to "bulk" very small seed by mixing with it finely sifted soil or saw-dust, as this enables the seed to be sown more thinly and evenly. When seedlings are large enough to handle they should be

carefully thinned out or regulated, retaining the stronger ones and discarding the weaker. Large seeds are in many cases affected in their germination by the position in which they are sown, although this is a matter not often taken into account by cultivators. Mr. Petch, the Ceylon Government Mycologist, has found that deformity in seedlings of Para-rubber is chiefly due to faulty position of the seed in germination, the shoot or plumule in consequence becoming entangled with the stalk of the seed-leaves (cotyledons). Out of 50 seeds which were sown horizontally with the inner or flatter surface downwards (which is considered the proper position), 48 germinated normally, while from a similar number sown vertically with the micropyle uppermost, only 9 normal plants were obtained. In the case of Coconuts it is customary to sow the nuts on their side, with the stalk end slightly raised.

Basket or Bamboo-plants.—For most trees or shrubs, an excellent plan is to sow the seed in plant-baskets or bamboo pots; in some cases two or three seeds may be sown together, the weaker seedlings being afterwards removed, leaving only one in each basket or bamboo. This method of raising plants not only facilitates transport, but also enables the plants, with their roots in the soil intact, being planted out in almost any weather with comparative safety. In the case of Rubber, Tea, etc., the advantage of basket-plants over stumps or seedlings from nursery-beds is obvious, and is usually well worth the extra cost entailed. Where baskets are not obtainable, sections of bamboo will answer the purpose, but these, unlike the plant-baskets, must be removed from the plants when the latter are being planted out. This is easily accomplished thus: split the bamboo along two sides with a blow from a knife, lay the plant on its side and invert the two halves of bamboo; this enables the latter to be easily removed when the plant is fixed in position and the soil is filled in around it.

Germination of Seeds.—The seed may be divided into three parts, viz., the germ, the body, and the skin. The germ or life principle is the *embryo*, consisting of the miniature plant with the leaves and stem in an undeveloped state. The body or *endosperm* is the reserve food which nourishes the embryo in germination until the root is advanced enough to derive nutriment from the soil. The *skin* or *shell* of the seed is for the purpose of protection. The four conditions essential to successful germination are: (1) a certain amount of moisture, (2) a favourable degree of heat, (3) a continuous supply of fresh air, and (4) protection from

strong light. In the absence of any of these conditions successful germination cannot take place. When the seed-coat or shell is hard and horny, it precludes air and moisture from the embryo, and thus prevents germination until it has sufficiently decayed. Certain seeds with extremely hard shells or endosperm take a long time to germinate, varying from 2 or 3 months, as in the case of the Nutmeg, to almost as many years, as with certain species of palms. In many cases, however, germination may be assisted by either filing or rasping the horny shell, or subjecting them to repeated soakings in almost boiling water. The former method may be applied to seeds with a hard horny shell, as those of Ceara-rubber (*Manihot Glaziovii*), while the latter may be adopted in the case of seeds with a very hard endosperm, as Indian-shot (*Canna*), Wattles (*Acacia*), and other leguminous sorts. The "rasping" or "filing" process is perhaps best carried out by holding the seed, when large enough to handle, for a few seconds against a revolving grindstone. A cooly with a seed in each hand, while another cooly turns the handle, will thus soon get through a large number of seeds. A method, known as the "bush method," sometimes adopted for hard-shelled seeds, is to burn a small bundle of hay or ferns over the seed-pot or bed, afterwards watering the soil with a fine rose. Another way of facilitating the germination of very hard seeds, is to place them in a hot fermenting dung heap. Indian Shot (*Canna*), Ceara Rubber seeds and others have been successfully started in this way. Soaking such seeds for about 5 minutes in a solution of sulphuric acid has been tried with good results in America. In hastening the germination of old or hard seeds, camphor dissolved in water has been found to have a marked effect. Experiments have also shown that treating seeds with chlorine water (2 drops chlorine to 60 CC. of water), and then placing them in the sun will accelerate germination. Another aid to germination is to water the seeds with a weak solution of formic acid (1 in 500), or with alkaline substances, as ammonia, soda, etc.

Testing vitality of seeds.—A popular way of testing the vitality of seeds is to place them in water, when if they float they are presumed to be bad. This, however, is sometimes misleading, as some seeds when in their prime float, and sink when in a bad condition, or vice versa. Seeds will either sink or float according to their specific gravity. Those which sink when good are of doubtful character when they swim. A strong saline solution, made with common salt, is employed in Japan for testing rice and other seeds. In this case, as above, all seeds that float are rejected,

and those that sink selected for sowing. A practical test is to cut or break open a certain percentage of the seeds; if in good condition the interior of the seed will present its natural and cheesy consistency. The surest test of vitality, however, is to sow a small representative quantity under the most favourable circumstances, as in specially prepared pots or beds under shelter. The proportion of seeds which thus germinate bears to the number sown, will afford proof of the quality of the seed. For testing very small seeds, they may be placed between wet blotting paper or damp cloth. It is a good plan when seeds are of doubtful quality to soak them in hot water previous to sowing; very often this may add 20 to 30 per cent. to the number of seedlings which would otherwise be obtained.

Acclimatized seed.—This term is applicable to seeds of any introduced and acclimatized plant, but in India it refers to European annuals and vegetables which thrive sufficiently well to produce good seed, capable of yielding satisfactory crops. In that country it has been found that in some cases such seeds give better results, at least for a time, than imported seeds. Though certain flowering annuals produce good seeds in the hill districts of Ceylon, no one, so far as I am aware, finds it worth while to save seed of European vegetables grown here. As a general rule, cultivation in the tropics has a deteriorating effect on the quality of all flowering plants and vegetables from temperate climates. Therefore imported seeds and fresh strains usually give the best results, and these are easily procured fresh from England or Australia.

Seeds of Aquatic Plants (water-plants), such as *Nelumbium*, *Nymphæa*, *Victoria regia*, etc., should be sown in pots submerged in shallow water. The pots should be raised on bricks, or such like supports, so as to bring them close to the water surface, thus securing greater warmth from the sun's rays than if placed deeper. Shallow still water is always the warmest.

Fern Spores should be sown upon fine sandy loam in well drained pots or pans. The spores should be gathered before the spore-cases have burst, and be sown at once, the soil being well watered before the spores are scattered over the surface. The pans or pots should then be stood in saucers of water, and a pane of glass placed over the top until the spores have vegetated. Instead of separating the spores from their cases (*sporangiums*), fragments of matured fronds may be laid on the surface of the prepared soil, when the spores will fall out themselves. Neither covering of soil nor watering is required, it being sufficient to

keep the vessel in which the pot is placed filled with water, as described above.

Orchid seed.—Experts in orchid-growing formerly sowed the seeds upon the surface of the material in which the orchid plants were growing, as owing to the presence of a symbiotic fungus it was supposed that the seed could only be grown in this way. Good results are, however, now generally obtained by sowing orchid seed on finely chopped moss or similar moist medium.

Propagation by Cuttings.—With the exception of seeds, this is the commonest method of propagation and, as a rule, the most expeditious and satisfactory. Propagation by cuttings as compared with that by seed has special advantages. By the former the peculiarities of the parent are reproduced as if the cutting were still a part of it, whereas by seed the special characters of the parent are often not perpetuated. In the tropics, a very large proportion of plants may be readily propagated by cuttings, especially if these are inserted in suitable soil during the rainy weather; some species, as the Dadap (*Erythrina lithosperma*), thus strike root so easily that if stems or branches are used as fence posts they will soon develop roots and sprout into leaf. In other cases, however, as with species characterized by hard wood or hollow stems, it is difficult, if not impossible, to induce cuttings to strike root. For successful propagation by cuttings, the following conditions are important, viz.: (1) firm and sufficiently ripened shoots from which the cuttings are taken; (2) a suitable rooting medium composed of a light porous sandy soil, or fine sand only; and (3) a higher temperature with closer atmosphere than that in which the plants grow when established.

It is believed that most cuttings strike root more readily if inserted in the ground sloping-wise instead of erect, and in the East the natives invariably practise this when planting cuttings for the Cassava crop, or cuttings to form hedges. The explanation probably is that the cuttings are thus more firmly fixed and that there is less evaporation of moisture from the portion underground. In preparing cuttings, the end of the shoot to be in the ground should be cut across with a clean slanting cut, just below a leaf-bud. The lower leaves should be cut off, leaving 3 to 4 eyes or buds to be under the soil when planted; the upper leaves if of a large size may be reduced to half. As to what is the best size for the cutting, this depends upon the nature of the plant. In the case of soft-wooded species, it is necessary to take rather large cuttings with a certain amount of firm woodiness; cuttings of young succulent

growth are liable to decay, especially if planted in the open ground. All cuttings succeed better at one season than another, and in many cases the most suitable period can only be found out by experiment. Generally speaking, however, cuttings will strike best at the commencement of the active growing season.

In taking cuttings of plants which are grown for their fruits or flowers, the upper shoots should be chosen ; thus in the case of Pepper, Cubebs, etc., it is well known that cuttings which are taken from the uppermost shoots are more productive and yield earlier crops than those obtained from the lower shoots. Similarly with flowering plants, cuttings taken from the extremity will flower early and in a comparatively small state. Thus, plants raised by cuttings from the flowering shoots of the climber *Camoensia maxima*, which usually takes several years to attain a flowering condition if raised from seed, have been found to blossom at Peradeniya in the nursery-bed when only about 16 inches high.

Although an open nursery is suitable for propagation by cuttings of most kinds of plants, many of the choicer sorts require to be struck in sand, under glass or other artificial covering. In glass-houses where artificial heat and moisture are under control, and bell-glasses for covering the cuttings are available, many kinds of plants may be raised by cuttings which would be impossible without these means. The bell-glass is of great advantage in preventing excessive evaporation and maintaining a warm and moist atmosphere around the cuttings. It is well known that cuttings will strike better when placed against a porous substance, as the inside of a flower-pot half full of sandy soil or sand only. This fact has lately been taken advantage of in establishing a low hard-wooded plant, *Malpighia coccifera*, as an edging to the drives in Peradeniya Gardens. Edging tiles were first laid along the sides of the drives and paths, and the Malpighia cuttings, being inserted against these, struck root readily and formed an excellent dwarf edging not unlike Boxwood. A simple method of striking small cuttings is as follows : Fill a flower-pot half full of sand and soil ; insert cuttings of a length sufficient to reach, within a little, the rim of the pot ; sink the pot in the earth, and cover with a pane of glass. The glass should be turned each morning so as to dispose of the condensed moisture on the underneath side. Another excellent plan, practised in India, is thus described:—"Procure a large flower-pot, and at the bottom of it place large loose pieces of brick, just so high that a small flower-pot placed inside upon them may have its rim on the same level as the rim of the large pot.

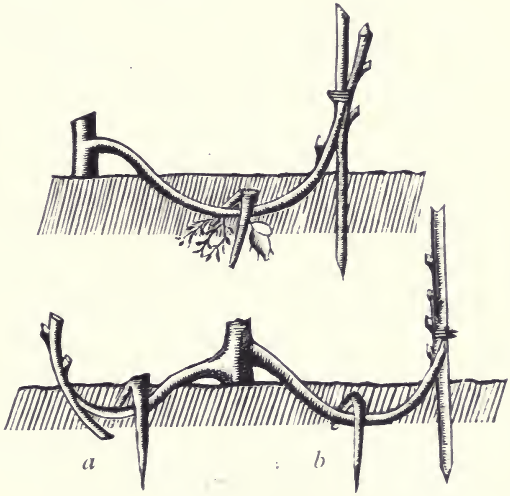
Fill in the space between the pots with perfectly dry sand or earth. Then fill the inner pot with pure sand, and insert the cuttings. Take another pot just of a size that when inverted it may fit in on the earth between the rims of the large and small pots; break out its bottom, and lay over it a piece of window glass. Water the cuttings as they require it with tepid water, allowing none to fall on the earth between the pots. When condensation of moisture takes place on the pane of glass, merely turn it over."

Striking cuttings in water.—This method is sometimes practised with ornamental plants, and with but little trouble is usually successful. The points to be attended to as conducive to success are: (1) Cuttings to consist of the ends of young vigorous shoots; (2) capacious opaque or shaded bottles; (3) water to be changed often to avoid its becoming foul; (4) the water to be replaced with tepid water when changed; (5) the cuttings to be sheltered from wind and direct sun. Aquatics and most plants which like moisture can be readily multiplied by means of cuttings kept in water or in a moist condition.

Cuttings of Cacti.—Striking cuttings by drying them in the sun is effected in the case of Cactus and similar succulent plants. Sections of these being taken and placed on dry sand will, when become partially shrivelled, produce roots. If placed in the soil in a freshly cut condition, they are liable to decay.

Propagation by Layers.—A layer is a branch or shoot, part of which is introduced into the soil, and strikes root whilst fed by the parent plant, with which, however, its communication is generally partially interrupted by a cut, slit, or ligature. When propagation by cuttings fails, layering may be resorted to, the latter, though a slower process, being often a more certain method. The operation is as follows: Select a branch of ripened wood of the plant to be layered that will bear being bent down to the earth without breaking; cut the branch half through with a sharp knife just under one of the leaf-buds, towards its extremity, and then pass the knife upwards, so as to slit the branch about an inch or two up. The slit-piece, with the leaf bud at its extremity, called the "tongue," should be kept open by inserting a small pebble or piece of brick. Bend the branch down, and where the tongue falls remove the earth to the depth of 2 or 3 inches; the tongue part of the branch is secured in that position by a forked peg, and then covered over with a mixture of fine sand and leaf-mould. This must be kept shaded and moist, to facilitate which an inverted flower-pot may be placed over the spot where the slit is. There

are various modifications of this method, and these may be varied to suit individual plants or trees or local circumstances. When the branch to be layered is too rigid to bend down, it may be made to pass through a broken flower-pot or other receptacle, the latter being filled with leaf-mould and sand, and placed on a support. A simple and successful method is to pass the branch longitudinally through two half-round tiles, the space between these being filled with fine sandy soil, and the ends filled with moss to prevent the soil running out ; the tiles are then tied together, and the whole watered regularly.



LAYERING :—(*a*) TONGUEING ; (*b*) RINGING.

Gootee layering.—This mode of propagation has been practised in India and China from early times. It is adopted in the case of trees which are difficult to raise by cuttings, or to which other methods of layering cannot be applied. The *modus operandi* is as follows : Select a firm healthy branch with well-ripened wood ; immediately under a leaf-bud or node, take off a small ring of bark, about one inch wide ; or make a slanting deep cut upwards, placing a small stone or a piece of stick in the groove to keep it slightly open. To this apply a ball of clayey soil, holding it securely together with coir fibre, tow or moss, bandaging all firmly round the branch. A little above this hang an earthenware pot, and through the hole in the bottom of the latter draw from

within a piece of thin rope; a knot tied at the end of the rope should fit tightly against the hole of the vessel above. The rope, secured by its knotted end within the pot, is carried on at full stretch and coiled round the gootee. By this means the water, with which the vessel is kept supplied, oozes slowly out, trickles down the rope, and so distributes itself over the whole gootee. In

"GOOTEE" GRAFTING.

from three to four months, according to the plant in hand, young roots should be seen protruding through the gootee, when the branch may be cut from the parent tree, and planted where it is intended for it to remain. The operation should be carried out in the wet season, commencing when active growth in the tree begins.

A modification of the "gootee" contrivance is a piece of thin tin plate, folded in the shape of a funnel, and fixed with clips round

the branch. It is filled with moss or soil, which is kept moist by a drip from a bottle of water fixed above it, with the cork pierced so that the water can drip slowly on to the branch operated upon.

Propagation by Suckers.—A sucker is a stem or shoot which springs from a subterranean portion of a plant or tree. Two kinds of suckers may be distinguished, namely *root suckers*, which arise from adventitious buds on the roots, and *stem-suckers* which spring from the base of the stem below the surface of the soil. The former can be severed from the parent plant and removed with roots attached. Bananas (Plantains) are a familiar example of this process of propagation. *Stem suckers* spring from the base of the stem, at or below the surface of the soil, and their growth is at the expense of the part of the plant above them. Plants which have been heavily pruned or pollarded, often produce stem-suckers freely. The latter when required for propagation may be encouraged to produce roots by partly severing them with a knife from the stem, and earthing them up with some good sandy mould, which should be kept moist. Stem-suckers are generally injurious to the plant producing them and, especially in the case of grafted or budded plants, should be cut away as fast as they appear, unless they spring from the scion and not from the stock. Pineapples are generally propagated by means of stem-suckers.

Propagation by Leaves.—Many succulent plants, as Begonias, Gloxinia, Bryophyllum, etc., may be increased from leaves. The latter should be placed on a damp surface of a light sandy soil, and kept in position by being partly buried, or held down with small wooden pegs.

Propagation by Eyes.—Many plants, especially those of a succulent nature, may be propagated readily by eyes or buds. The method is simply to take a plump shoot or stem on which there are buds not yet developed ; cut this in a slanting direction into short lengths, about $\frac{1}{3}$ inch above and below the bud. The pieces, having at least one eye or bud upon each, are planted firmly in a pan or box of fine sand and soil, with which they should be just covered. The sand or soil should be kept moist and shaded, and the eyes may be further encouraged to start into growth by a sheet of glass being kept over the surface.

Propagation by Roots.—Some plants may be readily increased by cuttings of the roots, these being inserted in a sandy mixture of soil, and kept damp and shaded. Aerial roots, developed from the upper limbs or branches of species of Ficus and other

trees, may sometimes be used as a means of propagation. When these reach the ground they at once fix themselves in the soil, and in a short time form stout independent columns or trunks. The latter will afford support to the parent tree and thus prolong its life, or they may be severed, and thus become independent trees. Where "Gutta Rambong" (*Ficus elastica*) is systematically cultivated for rubber, these root-stems are regularly tapped for their latex. The method adopted in Peradeniya Gardens for enabling the ærial roots of Ficus trees to reach the ground and strike root is as follows: Long bamboo stems (preferably the Giant-bamboo) are split into two, the transverse divisions being cut out; the two halves are placed together round the aerial root, or at least the portion of it nearest the ground. The bamboo sections are then tied together, the lower ends securely fixed in the ground, and the top filled in tightly with moss to prevent the ingress of rats or squirrels, which feed on the delicate young roots.

Division of Root-stock.—By this method plants which grow in clumps, or have a fibrous or tuberous root-stock, as herbaceous perennials, are easily multiplied. "Division" consists in separating portions of the main plant, each portion bringing with it some of the roots; if planted under suitable conditions either in pots or out in the field, these soon become established and form new clumps. To many plants of this nature the process of lifting, dividing and replanting each year is beneficial rather than otherwise, as if left undisturbed for a long period the soil becomes impoverished and the plant more or less exhausted. Orchids and herbaceous perennials are generally multiplied by division.

Propagation by Bulbs, Corms, and Tubers.—Bulbs or tubers may appear on plants either underground, or on the stem or branches above the ground. In some Yams (Dioscorea) both underground and ærial tubers are found on the same plant. A bulb is composed of either modified leaves in the form of scales, as in Lilium, or of the thickened bases of ordinary leaves folded round each other, as in the onion and Crinum ("Tolobo," S). *Bulbil* is a term applied to a small bulb, but more generally to *aerial buds* when they assume the form of small bulbs, as in the case of some ferns, Sisal-hemp and allied plants. Sometimes such bulbils are produced in large numbers (e.g., Sisal-hemp), and take the place of seeds in the function of reproduction, the seeds themselves being habitually either abortive or infertile. These bulbils, if planted in a nursery bed, will in due course grow into large plants. A *corm* is a short, solid, conical tuber or a modified underground stem, from which

roots spring chiefly from below, but also on the sides and upper portion; buds also are scattered over the upper surface. Corms multiply usually by means of offsets. Caladiums and most other Aroids are propagated by planting either the whole corm, or only the "eyes" (buds) which are developed on the upper side of the latter. A *tuber* is a thickened rhizome or stem, bearing buds or node-like scars, examples of which are Yams, Sweet-potato and Artichoke. Propagation of these is effected simply by division.

SHOWING AERIAL ROOTS OF *Ficus altissima* BECOMING ROOTED IN THE GROUND AND FORMING INDEPENDENT STEMS.

The fleshy subterranean growths of the Dahlia are not true tubers, but enlarged succulent roots, as they do not bear buds.

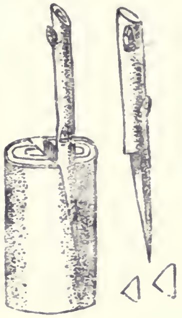
Propagation by Runners and Rhizomes.—This natural mode of propagation is well seen in the strawberry plant and in some "running" grasses. A slender branch is sent off from the base of the stem; it runs along the ground, and at its end produces a new plant. The branch withers and dies as soon as the new plant is rooted. Some plants also have creeping stems (*rhizomes*), which root along their under surface, and develop new plants from buds on the upper side. This is characteristic of the Ginger family and most grasses.

Grafting.—Grafting consists in placing together two cut surfaces of one or of different plants in such a way as to cause them to unite and grow together. The plant on which the graft is inserted is called the *stock*, and the part inserted the *scion*. The action of the one on the other is often very marked, sometimes producing what are called "graft-hybrids." Some fruit-trees may grow freely on a certain stock but scarcely bear any fruit, whilst on another stock they produce abundant crops, though they may not grow so vigorously. The possibilities of grafting are of the greatest importance in horticulture, more specially in fruit-growing industries, and through its medium trees, shrubs, etc., may be propagated when other reproductive means fail. Among its other advantages are: The good qualities of the scion are retained; seedling fruit-trees are brought more quickly into bearing by being grafted on fruit-bearing stocks; and in some cases the two sexes of diœcious plants may be brought together on one stock in order to ensure their reproduction by self-fertilization. In Ceylon, however, as in most tropical countries, grafting is seldom practised.

Certain conditions are essential for the success of the operation. The scion and stock should have a natural affinity to each other, either as varieties, species, or genera of the same natural order; also the natural vigour of the stock and scion should be somewhat similar. The operation should be carried out in the shade in moist, growing weather, and the parts protected from the sun until the union is complete. In all cases it is necessary to exclude the air from the graft by covering it with grafting-wax or clay, bound round with matting or fibre. A fundamental principle is the necessity of forming a direct communication between the layers of inner bark (*cambium*) in both the scion and stock; otherwise no union takes place, as the pithy or woody parts do not unite. There are various methods of grafting that may be practised, according to the size and variety of the subject which it is intended to propagate, and each method may be varied to some extent as may be desired. The following are the modes most generally employed:—

Whip or tongue grafting.—This is one of the best methods and is extensively practised in cool countries. The stock is cut in a sloping direction, just above a node. The scion is then similarly cut through obliquely; a thin tongue is cut in this in an upward direction, and a corresponding cut made in the stock; the scion is fitted into the latter so that the inner barks of stock and scion come

in contact with each other. The graft is then bound firmly to keep the parts in position, and covered with clay or grafting wax for excluding the air.



CLEFT-GRAFTING.

Cleft grafting.—The stock is split open by a chisel, and the scion, being cut wedge-shaped, is fitted in the cleft, so that the inner barks may meet each other. This mode has obviously certain objections, and is chiefly adapted for plants with old stocks.

Saddle-grafting.—In this the stock and scion must be of nearly equal thickness, as the former is cut sloping on each side, like a wedge, and the latter is split up the centre and thinned so as to allow of it fitting accurately on top of the stock. This method is suited to shrubs and young-wooded plants.

SADDLE-GRAFTING.

Wedge-grafting.—This is the same as the preceding plan, with the position of parts reversed.

Crown or Rind-grafting is applied to trees of considerable size. A scion, about 6 inches long, is selected; the lower half is cut in a sloping direction, and the notch or shoulder formed in cutting it is made to fit on top of the stock. It is then inserted between the bark and wood. This can only be done at the commencement of the growing season, when the bark and wood easily separate.

CROWN OR RIND-GRAFTING.

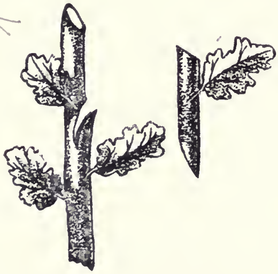
Side-grafting consists in inserting scions into the branches or sides of the stock, without cutting away the head of the latter. It is useful for supplying, where deficient, a branch or stem to any part of a tree. The scion being splice-cut and thinned out, it is inserted under the bark, the union being bound up and covered with clay or wax.

SIDE-GRAFTING.

Veneer-grafting is chiefly used for propagating trees and evergreen shrubs. The scion is cut with an even splice-cut, about 1 in. long; a corresponding quantity of bark is taken off the side of the stock; both are then fitted together, without a cleft or incision being made in the wood.

INARCHING.

Grafting by approach, or Inarching.—This is the best system of grafting known, and natural examples are frequently seen in trees growing together. It is specially suited to the tropics, and is successfully applied to Mangoes and other fruit trees. Nutmeg, Cacao, Coffee, etc., may also be propagated in this way. The scion in this case must be grown in a pot or bamboo, so as to be movable, or planted close to the stock. In the case of large trees which it is desired to increase in this way, a temporary platform may be erected near the tree upon which the scion-plants are placed in pots; the shoots of the tree may thus be easily bent down to reach the scions. The mode of procedure for inarching is to remove a similar portion of the wood from both the parts intended for joining; these must then be carefully fitted together and secured with tying material and a bandage. When the parts have united, dissever the scion from the parent plant below the bandage. The grafted plant must be kept in a shaded place until it has commenced active growth, and stock and scion have become thoroughly incorporated.

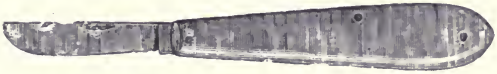


HERBACEOUS-GRAFTING.

Herbaceous-grafting is applicable for increasing plants of a herbaceous nature while still growing. By its means the Melon has been grown successfully upon the Cucumber, the Tomato on the Potato, etc. The stock and scion being nearly similar in texture, the former is carefully split, and the scion prepared wedge-shaped and inserted rather deeply, allowing the barks to coincide, as in all other methods. Tie with worsted, cover the cut with grafting-wax, and shade from the sun.

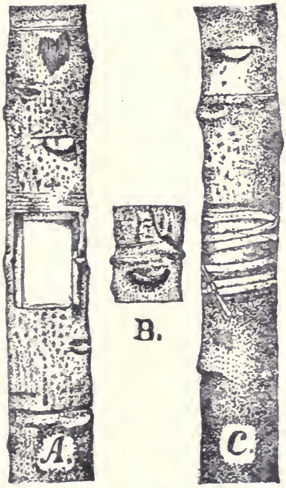
Budding.—This process, which is a species of grafting, consists of taking an "eye" or bud attached to a portion of the bark, and

inserting it in the stem or branch of another plant. A condition necessary to success is that the sap be in active circulation, so that the bark may detach itself readily when gently lifted from the wood. This is found to take place best where very marked seasons of growth or "flushes" occur. In equatorial regions, where the



A BUDDING KNIFE.

seasons are not so marked as in temperate countries, the operation of budding is not always successful. There are various forms of budding, each better adapted to particular circumstances, as *Shield* or *T-budding*, *Flute* or *Tube-budding*, and *Annular* or *Ring-budding*. The first-named form is the one chiefly practised for roses and fruit trees. The *modus operandi* is thus: Select a shoot well furnished with plump dormant buds from the plant desired to be increased; cut off the leaves at half the length of the leaf-stalks. Remove a bud from the shoot by entering a knife ½ an inch below the bud, between the inner bark and the wood, sloping the knife outwards above the bud. The small portion of wood taken with the bud is carefully removed. In the bark of the young shoot in which the bud is to be inserted, make an incision in the form of a "T." Raise the bark carefully, push the bud gently into the opening, bind it securely to exclude air, leaving only the point of the bud exposed. Dull cloudy weather and morning or evening are the best time for budding, and the operation must be performed as quickly as possible, as both bark and bud are injured if exposed to the air for any length of time. Special knives are supplied for the purpose, and an instrument known as the "bud-transplanter" may also be employed.

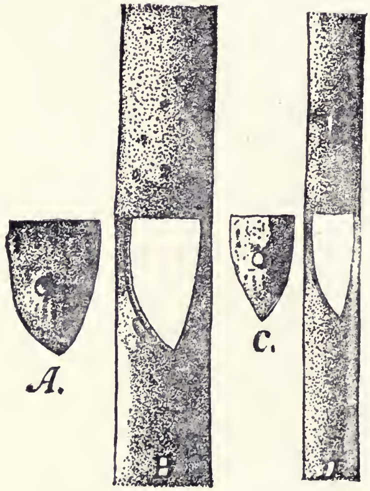


RECTANGULAR PATCH-BUDDING OF MANGO.

FIRMINGER said: "In the upper Provinces of India budding is performed with great facility at two seasons of the year; but,

for some reason I am unable to explain, I have not found such to be the case in the vicinity of Calcutta, where budding can so seldom be performed with success that it is rarely or never attempted, inarching being uniformly adopted instead." MR. FAWCETT, late Director of Botanic Gardens, Jamaica, recommends budding as a quick way of establishing a Mango orchard in that country. MR. HARRIS of Jamaica has been successful in budding Cacao, and found that the Criollo and Calabacillo thus "gained enormously in vigour and productiveness." Budding is applicable to various kinds of fruit trees. In the West Indies it is claimed to have been "so successfully applied to the Nutmeg trees, the grafting of which has not proved practicable, that the sexes of these may now be brought under the control of the cultivator." In regard to budding Mangoes, the secret of success is said to lie "in taking the buds from about the middle of the growing shoot where they are well developed, and yet not too tender, at a time just prior to a vigorous stage of growth in the tree to be budded.

Bud-grafting.—In Queensland and the Southern United States, this form of budding has of late been adopted with success in the propagation of the Mango. It is considered to be much more rapid than "inarching" or "grafting by approach," and does not, like the latter, involve the erection of a structure laden with pots around the tree to be multiplied. As applied to the Mango, the mode of procedure is thus described: Seedlings 2 to 3 years old, with stems about an inch in thickness, are selected for stocks. A rectangular piece of bark is removed from the stock, and in its place is inserted a piece similar in shape, with a bud in the centre, taken from the variety of Mango which it is desired to propagate. The bud-wood (i.e., the shoot from which the bud is taken) should be not less than 2 years old. Precision in fitting the bud-bark with the incision in the stock are important factors for success. A small quantity



BUD-GRAFTING OF MANGO.

of grafting wax should be smeared over the edges of contact, and the bark then tied firmly with strands of bast, as shown at C in the accompanying figure. After this, the graft (excepting the bud) should be covered with strips of cloth dipped in melted paraffin wax, as a further preventive against the admission of air and moisture between the cut surfaces of stock and scion. If unduly exposed to the sun, shade should be provided by means of strips of paper tied over the bud. After union of stock and scion has taken place (which should be effected in 2 or 3 weeks), the bandaging may be removed, and the stock pruned back.

Grafting-clay is a composition for covering the graft to exclude air and moisture until a union of the stock and scion is effected. It consists of two parts clay and one of cow-dung. These ingredients should be beaten together and thoroughly mixed until of the consistency of fresh putty, sometime before being required.

Grafting-wax.—This is employed in grafting small or delicate plants, where the use of clay is scarcely practicable, but may also be applied to large plants if desired. It is of various forms, and may be purchased in boxes from seedsmen. To make grafting-wax, melt slowly together one part linseed oil or tallow, one of beeswax, and four of resin. For use, re-melt in a glue-pot, and when the wax is of consistency to work freely, apply with a small brush.

Nurseries.—A necessary part of the equipment of a garden or estate is a nursery for the propagation of plants. The essential points of a good nursery are shelter from wind, a plentiful supply of water, light shade, and fine, loose, well-drained soil. On an estate, a sheltered valley with a stream running through, should be selected as the most suitable site for the purpose. The ground should be cleared of brushwood, rough stones, roots, etc., the soil trenched or deeply dug, and raised into beds of uniform level. The beds may be a few inches high and of any convenient size, but for facility of working they should not be wider than 3 or 4 ft., and an alley of 12 to 16 inches must be left between them. The surface soil must be brought to a fine tilth, and freed from stones, especially for seed-beds. No stable or farmyard manure should be mixed with the soil, unless it be in a thoroughly decomposed state; alluvial or loamy soil, with some well decomposed leaf-mould and fine sand added, forms the best medium for germinating seeds as well as for striking cuttings, layering, etc. Temporary shade for beds must be afforded. This is easily provided by fixing forked

sticks, about 2 ft. high, alongside the beds, light bamboos or other sticks being placed over these lengthwise and across, while cadjans or other material used for shade can be laid on the top and regulated or removed as required.

Nursery-, or Propagating-sheds.—In the hill districts some protection from wind and rain is usually indispensable. A serviceable shelter may be afforded by erecting a half-span roof of thatch, either over the beds where formed, or in a sheltered corner specially set apart for propagating purposes. The roof should be about 3 ft. off the ground at the back, about 5 ft. in front, and facing the morning sun. Such structures are also useful for the cultivation of such crops as Tomatoes, Cucumbers, Violets, etc., which thrive best under protection.

PLANT BREEDING

The term plant-breeding is applied to the improvement of plants by producing new strains, whether for economic or ornamental purposes. Its effects are of equal importance to the planter, farmer or gardener, and upon it depends the profitable cultivation of many crops or races of plants. The great progress made in horticulture and agriculture during recent years is chiefly due to the patient efforts of the plant-breeder. Briefly stated, the process consists of crossing or hybridising selected species or varieties which possess specially useful or desired characters, the method of procedure being to transfer the pollen or male element from the flower of the one plant to the pistil (respective organ) of another. By this means, together with the aid of high cultivation and a process of careful selection of the best varieties, many entirely new races of plants have been evolved. Thus have originated most of the choicest flowers of the garden, and the most luscious and productive fruits and vegetables.

Until comparatively recently, the possibility of producing a hybrid was considered to be confined to plants of different species belonging to one genus, it being generally believed to be impossible to produce a cross between different genera. Now, however, we have bigeneric and multigeneric hybrids, and new generic names have been created for them. Thus, there is the *Citrange*, a cross between a citron and an orange; the *Plumcot*, a hybrid between the plum and the apricot. Great advances have been made especially in the bigeneric hybridisation of orchids, so that we are now familiar with such bigeneric titles as *Odontioda* (a hybrid between

Odontoglossum and Cochlioda), *Miltonioda* (a hybrid between Miltonia and Cochlioda), *Vuylstekeara* (a multigeneric hybrid between Miltonia and Odontioda), *Laelo-cattleya*, and others. (See beginning of Chapter, under *Selection and saving of seed*).

MENDELISM

The law of heredity known as Mendel's Law, discovered in the sixties of the last century by the ABBE GREGOR MENDEL, has now become almost a household word, and may be described as the basis of scientific plant-breeding. Until this law was demonstrated all breeding, or cross-breeding, was effected to a large extent in the dark, and although as a general rule the peculiarities of the present generation might reasonably be expected to reappear in the progeny, what would actually happen could only be guessed at beforehand. Often when crosses were attempted, although the greatest care was exercised, no apparently successful result was obtained, the progeny exactly resembling one parent only. MENDEL conceived, however, the idea that the puzzling results of cross-breeding must be governed by some settled law. He therefore set himself to work to find it out, and in order to do so started his experiments on the simplest lines he could conceive. He selected the various forms of the edible or garden pea on the following grounds: *Firstly*, the flowers of these are so constructed that from the outset their anthers and stigmas are protected from outside pollen (which, of course, would produce unwished for crosses) by being enveloped in the keel of the flower, and by opening this keel before the flower was fully grown, he could extract the unripe pollen-bearing anthers and insert instead the ripe pollen he desired to use, thus ensuring the desired cross. *Secondly*, these plants show definite and distinct characters, such as differently coloured flowers, and variously coloured and shaped peas, as well as pods. *Finally*, as they are annuals, a fresh generation could be obtained every year for the purpose of studying and tabulating results, and starting fresh experiments. From these experiments MENDEL discovered that the characters aforesaid fell definitely into two distinct categories, viz., (a) *dominant* and (b) *recessive*. A dominant character is one which appears to the exclusion of the other in the immediate offspring of a cross, the character which fails to appear being recessive.

The next discovery was that in a cross involving a dominant and a recessive character; all the offspring resembled the dominant one, so that apparently the recessive parent had failed altogether

to act, even though it was this parent which bore the seed, for the same result occurred whichever was the seed bearer. This first family of "dominants" being self-fertilised, the next remarkable result was that from their seeds arose two kinds of plants, viz., dominants and recessives, like the grand-parents, but always in the proportion of three dominants to one recessive when the average of a large number was taken. Here then was an obvious law, and long series of crossings and intercrossings proved that the characters, "dominant" or "recessive," never intermingled absolutely, but only temporarily; so that when another period of reproduction occurred they were capable of dissociation or segregation.

"In the reproductive cells," says Dr. R. H. Lock, "the dominant and recessive characters separate completely only on being represented in each cell. Such cells occur in equal numbers. When the reproductive cells unite they do so at random, so that in the long run the combination DD, DR, RD, and RR are equally recessive. DD is a pure dominant like the dominant parent, and will always breed true to this character unless again crossed; the same applies to RR, DR and RD which are crosses like the original cross; like it they are dominant in appearance, and their further behaviour is exactly the same. The apparent 3 to 1 ratio is thus explained. It is really a ratio of 1 : 2 : 1.—i.e., 1D : 2 DR : 1 R. D and R breed true. DR makes up again like the original cross." In Mendel's experiments the same ratios of "dominant" and "recessive" came out in all cases where sufficiently distinct characters presented themselves; and, above all, the same "dominant" prevalence in the first family was found to assert itself. This, for the plant-breeder, was in itself an invaluable discovery, since without this knowledge it often took years to establish a really reliable strain. He now knows that, instead of rejecting his crosses as failures, he has in them probably precisely the cross he desires, and has only to cross them again to obtain it in the succeeding family. Furthermore, he now knows exactly how to proceed in order to obtain a pure and constant strain on systematic lines. To those who may desire to pursue experiments on Mendelian lines, it is advisable to point out that it is only by doing so to a fairly large extent that this ratio becomes clear on averaging the results. The principle underlying the predominance of the dominant characters over the recessive in the results obtained has been compared to that shown by mixing up a large number of black and white shots in a bowl, three black and one white, and employing a blind man

to pick out four at a time; the law of chance will then determine that the groups of four will average out three blacks to one white.

Those who desire further information on this interesting and important subject should refer to Dr. R. H. Lock's Pamphlets on plant-breeding, or, for more advanced information, to his book entitled "Variation, Heredity and Evolution."

CHAPTER VII.

CULTURAL OPERATIONS

PLANTING

Planting, or the transference of plants, trees, shrubs, etc., from their pots or nursery beds to places in the open ground where they are intended to remain, may usually be done in the tropics at any time, except in the dry season (see under *Climate*), the most essential condition being that the soil be in a moist, though not excessively wet, state. In the low-country of Ceylon, planting operations may commence at the setting in of the monsoon rains, but should not as a rule be attempted during the months of January, February, and March. As regards the hill districts, however, certain delicate annuals and exotic plants are liable to suffer from excessive rain, and these should not be planted out until the burst of the Monsoons (June and October) has somewhat abated. Except perhaps in very wet weather, a good watering should invariably be given to plants when either planted out or transplanted from one place to another. As annual crops should be sown in drills, so all shrubs or trees that are cultivated as crops should be planted in rows, the plants in each row alternating with those in that next to it.

Holing.—It is very important, especially in poor soils, that sufficiently large holes be made in the first place, for otherwise the plants are liable to languish and become stunted or irregular in growth. The proper size of the hole depends upon the nature of the tree to be planted and on the character of the soil. For moderate-sized shrubs, the holes should be about 2 ft. in diameter and about 20 inches deep; while for fruit and other trees they should be proportionately larger. In any case it is well to dig large deep holes, and fill to the depth required by the particular plant in hand. The soil that is taken out should be mixed with some manure, or any well-decayed organic matter available, before filling it in again. It is important that the soil should be pressed firmly about the roots of the plant when the latter is placed in

position. With most plants it is customary to fill in the soil so that when quite settled it is slightly higher on the surface than the surrounding level; this avoids the risk of stagnant water accumulating round the young plant. With coconuts, however, it is usual to only partially fill in the hole when planting the seedling, so that the crown of the latter is left about a foot below the level of the ground. Not only is the young plant thus afforded beneficial shelter, but its roots obtain a deep and firm hold of the soil, and the hole becomes filled up in course of time by the process of weeding and weathering. (See *Use of Explosives*, p. 46).

Puddling roots.—An excellent practice, either in planting or transplanting, is to puddle the roots in mud immediately the plants are taken out of the ground. A mixture for puddling may be made simply by adding water to some earth, and stirring it until of the consistency of thick paint. If the soil be too porous for the purpose, it can be made adhesive by adding cowdung or clay. By dipping the roots in the mixture a coating adheres to them which has the effect of excluding the air, thus to an important extent keeping them moist. This method is especially beneficial in the case of plants which have to be carried over long journeys, or are unavoidably out of the ground for a considerable time; while during a period of uncertain rainfall its adoption may be recommended for almost any class of plants.

Transplanting.—It is often necessary in gardens, and even on estates, to transplant shrubby plants or small trees, either to more suitable places or for the purpose of filling vacancies or replacing weakly plants. In the case of large bushes or spreading trees, it is advisable to cut these well back first, so as to reduce their foliage or transpiring surface, thus balancing the latter with the check received at the roots. Having well-soaked the ground with water, dig a trench round and under the tree or shrub so as to leave a good ball of earth adhering to the roots. The ball with the roots must be kept intact, and if the soil be of a loose nature matting or sacking should be tied around it. By sliding in planks underneath, the tree or shrub may then be safely removed. This should be replanted exactly at the same depth as it was growing. After cutting off any injured portions of the roots, fill in the hole with good soil, pressing or ramming it firmly around the roots as you proceed. Finish by giving a thorough soaking of water, placing a layer of mulch on the surface; fix supports round the tree to prevent its being moved about by wind, and shade well until new leaves have developed.

Shading.—In the tropics it is absolutely necessary to protect young plants, on being first put out in the open ground, from the powerful rays of the sun, by means of some temporary shade. Even when well established, many plants are always liable to be injuriously affected by direct exposure to the sun during the hot dry season, and are greatly benefited by partial shade. For some quick-growing young crops, as Tobacco, Vegetables, etc., it is usually sufficient to shade them with any large leaves or fern fronds that may be at hand, these being fixed in the ground by their stalks and bent over the tender seedlings. Twigs or fern fronds which do not readily drop their leaves or leaflets when withered are the most suitable for the purpose. The pretty fern *Gleichenia* is, for this reason, a most useful plant, its wiry persistent fronds being especially suited for inserting slanting-wise in the surface of nursery beds. For newly planted seedlings or other young plants, plaited palm leaves, especially those of the coconut (cadjans) afford excellent temporary shade, the leaves being loosely woven into a basket-like shape which is placed over the plant and held in position by means of 3 sticks fixed in the ground.

Watering.—Though it is always best to plant in rainy weather, it is often impossible to follow the progress of the elements, and as moisture as well as shade is usually a necessary condition for newly planted plants, watering by artificial means must be adopted when the rain fails. (See *Watering of Pot Plants*).

Tree-guards and supports.—In public grounds especially, protection of some sort is, without exception, indispensable to young plants which are intended to form useful or ornamental trees. A fence of the "solid" or "male" bamboo forms a substantial protection for a time, but the most effectual and durable supports and barrier are iron tree-guards; those in which the uprights are pointed at the top and bent outwards are preferable. In exposed or windy situations, it is often necessary to support plants individually, especially those with slender stems, by fastening them to firm stakes fixed in the ground. Such support should as a rule be provided at the time of planting, and care must be taken that the plant does not chafe against it, and that the tie is not left on too long.

Planting Distances.—The proper distances for planting apart vary, of course, according to the nature of the plants or crop, and also to some extent according to local conditions of soil and climate. As a general rule every individual plant or tree should be afforded sufficient space to allow of its healthy and profitable

development. Such distances, in this work, are usually given under the different classes mentioned, except where a repetition of this is unnecessary or impracticable, in which case the necessary spacing may be inferred from the approximate size of the respective species at maturity. When marking out the land for planting, the rows should be at equal distances apart, but it is usually desirable that the distances between the rows be greater than that between the plants in the rows, thus facilitating working between the rows. The plan known as the *quincunx*, shown in

ALTERNATE OR QUINCUNX PLANTING

figure, is the proper method of placing the plants in rows. In this, as will be seen, the plants in any row alternate with those in the row on either side, while they are also in straight lines in whichever direction looked at.

TABLE OF PLANTING DISTANCES

The following table shows the number of plants to the acre at distances of one to thirty feet apart, and the area in square feet available for each plant :—

Distance apart in feet.	Area for each plant in square feet.	Number of plants to the acre.	Distance apart in feet.	Area for each plant in square feet.	Number of plants to the acre.
1 by 1	1	43,560	3 by 3	9	4,840
1½ by 1½	2¼	19,360	3½ by 3½	12¼	3,556
2 by 2	4	10,890	4 by 4	16	2,722
2½ by 2½	6¼	6,970	5 by 5	25	1,742

Distance apart in feet.	Area for each plant in square feet.	Number of plants to the acre.	Distance apart in feet.	Area for each plant in square feet.	Number of plants to the acre.
6 by 6	36	1,210	16 by 16	256	170
6 by 7	42	1,037	17 by 17	289	150
7 by 7	49	889	18 by 18	324	134
8 by 8	64	680	19 by 19	361	120
9 by 9	81	537	20 by 20	400	108
10 by 10	100	435	22 by 22	484	90
12 by 12	144	302	24 by 24	576	75
13 by 13	169	257	26 by 26	676	64
14 by 14	196	222	28 by 28	784	55
15 by 15	225	193	30 by 30	900	48

For numbers not given in the above table, take the square of the distance apart the trees are required to stand, in feet, into 43,560; the result is the number of plants required per acre.

PRUNING

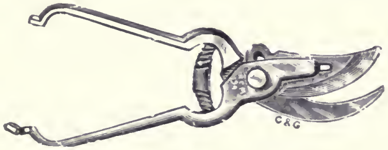
There are various modes of pruning, each class of plants requiring more or less different treatment, but the principle underlying all methods is the same. This may be briefly described as the concentration of vigour into certain parts of the plant by the cutting away of other portions, either of the stem, branches, roots, or leaves. The object in view may be the production of a larger yield or better quality of fruits or flowers, straight clean trunks (as in timber and rubber cultivation), twisted or bent stems (for furniture-making, etc.), wide spreading branches (for shade), or an abundance of young shoots and foliage, as in Tea cultivation.

PRUNING KNIFE.

By means of pruning, trees or bushes may be induced to assume a form which will not only add to their productiveness, but also facilitate the harvesting or plucking of the crop. The plants should be encouraged when young to form an evenly balanced head, with the branches radiating regularly from the centre. The more upright and straight a shoot grows, the freer will be the circulation of its sap, and therefore, as a rule, the more active its vitality. The effect of pruning is analogous to that of manuring, and this fact is taken advantage of when hard pruning is applied to bushes

which become stunted or "sick." Pruning may also be resorted to in order to rid plants of certain fungus diseases or insect pests.

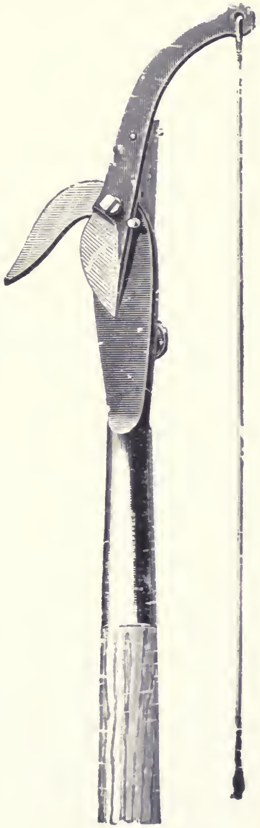
In Ceylon, the pruning of fruit trees is seldom practised, with the exception of the Grape-vine in the Northern Province and, to a small extent, European fruit-trees in the hill districts. Although the absence of a resting period in the tropics affects the question of pruning, there can be no doubt that some modified form of it to suit local circumstances should be adopted in order to maintain the trees in a productive condition, and to obtain the best quality of crop. In India a similar effect to that of pruning is sometimes produced by the crude practice of either stripping off the leaves, or subjecting the trees to a "good thrashing," as is done in the case of unfruitful Mango trees. The latter operation is effected by means of a long pliable bamboo, and although too crude to be recommended, yet its effect in retarding exuberant growth, and so tending to fruitfulness, is said to be sometimes conspicuous.



SECATEURS, OR PRUNING SHEARS.

Pruning of Shade or Flowering trees.—The object in regard to the pruning of these should be to obtain a form which, while developing the natural beauty of the tree, will tend to prolong its life and usefulness. The longest lived trees are those with a straight, erect and undivided trunk; therefore the production of such a form should be encouraged when the tree is young, by shortening back shoots or branches which rival the leader, and so direct the vigour of the tree to the centre.

General Principles of Pruning.—The following principles are of general application, whether for large or small



TREE-PRUNER.

trees :—

(1) For fruit trees, thin out branches so as to allow free access of light and air; remove all dead wood, snags, superfluous suckers and shoots.

(2) Always use a sharp knife or saw, and cut in such a way as to ensure quick healing.

(3) When cutting back lateral branches, always cut at a fork.

(4) In removing a large branch, saw it off roughly (cutting the under-side first, and then the upper a few inches further from the stem than the first cut) a foot from the trunk, and finally saw off and plane the surface of the stump left.

(5) Smear coal-tar over the cut surface; otherwise the action of sunheat may crack the wound, thereby allowing moisture to enter and enabling parasitic fungi to obtain a footing.

(6) When cutting branches, especially large ones, avoid leaving stumps several inches long; always cut a branch in a line and flush with the outside of the stem or branch from which it springs.

(7) The cut should always be made in a slanting or upright direction, so as to throw off the rain.

(8) In general, pruning should be performed when growth is least active.

PRUNING-SAW.

Thumb-nail Pruning.—A term applied to the nipping off of the terminal young bud, as done by the thumb-nail and forefinger, being a form of pruning conveniently applied to tender plants. At one time it was recommended for young Hevea rubber trees, being adopted when the trees were about 10 to 12 ft. high, the object being to induce a more rapid growth in girth of the stem and a branching top. This, however, is not now generally practised.

Root Pruning.—This is sometimes employed in the cultivation of fruit trees, its object being to counteract a too luxuriant woody growth, which results in paucity of fruit. The usual method of carrying it out is to cut a trench round the tree at a suitable distance from the stem, and as deep as the roots go. All the roots as they are found are cleanly cut, and if a long tap-root

is suspected of entering the sub-soil it should be searched for by careful undermining, and severed. In the North of Ceylon, where the climate is comparatively dry, the practice in regard to the Grape-vine is to remove the soil from around the base of the stem, and cut away some of the smaller roots. After exposure for a week or two the trench is filled in with manure, which is covered over with the soil previously removed. Similar treatment is applied in India to the Mango and other fruit-trees. "This," said FIRMINGER, "though apparently opposed to theory, is in fact more efficacious in practice, and the trees treated thus bear prodigiously."

BRANCH-PRUNER.

In the cultivation of fruit generally, the object should be to encourage the growth of fibrous roots near the surface, and prevent the development of strong woody roots into the sub-soil.

Cavities in Tree-trunks.—Very often when a tree has been long neglected, the trunk is seriously injured by cavities caused by the decay of dead or broken branches. It is not claimed that pruning can remove defects of this nature; but it can, with proper application, arrest the progress of the evil. The edge of the cavity should be cut smooth and even, and all decomposed matter in the interior carefully removed. A coating of coal-tar should then be applied to the surface of the cavity, and the mouth plugged with a piece of well-seasoned hard wood, securely driven into place, the end of the plug being then carefully pared smooth and covered with coal-tar. To guard against the attacks of insects or fungi, it is sometimes advisable to nail a piece of zinc over the board, in such a way that the growth of the new wood may in time completely cover it.

Bark-, or Hide-bound trees.—It is believed that in some cases cortical or bark pressure becomes so great as to retard the growth of the tree, preventing the formation of the normal amount of new wood. In temperate climates this unhealthy condition is considered to be indicated by the natural shedding of the leaves

being impeded. The remedy adopted is to make longitudinal incisions in the bark, without removing any tissues. This is believed to relieve the bark pressure, being followed by a natural increase in thickness of the affected stem.

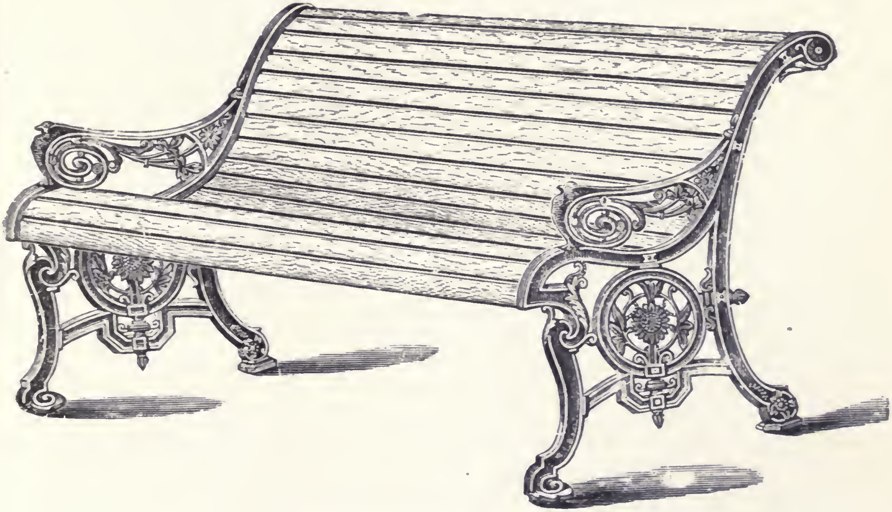
Ring-barking, or Ringing.—These are terms applied to the removal of a strip of bark, varying in breadth from a few inches to as much as two feet, according to the size of the tree, from near the base of trees which it is desired to kill by starvation. It is commonly adopted in some countries for killing large or other trees which would be costly to cut down. To be quite successful it must be performed during the period of greatest cambial activity, i.e., when the sap is up, as it is popularly called, the bark being then most easily separated from the wood; the excised bark must be cut sufficiently deep to expose the cambium, that is, the *bast* layer or inner bark must be removed, otherwise the operation will be ineffectual. The chief effect of this is to cut off the downward flow of sap and food material between the leaves and the roots. Where the trees are required for their timber, the process of killing by ring-barking is considered to improve the quality of the latter. A form of *ringing* is sometimes adopted to hasten the ripening of fruits, and, as a last resource, to render unfruitful trees productive. The principle is also employed in different methods of propagation, as a means of inducing the formation of a *callus* on cuttings or layers.

Pollarding or coppicing is a necessary process in the cultivation of certain tropical products, more particularly of Cinnamon and Cinchona. In effect it is also applied to Tea, Coffee, Camphor, etc., since it consists of cutting back the main stem and branches so as to keep the trees dwarf, and induce productive young growth.

CHAPTER VIII.

GARDEN ADORNMENTS, LABELS, IMPLEMENTS, Etc.

Seats.—These are always an essential part of the equipment of a garden, more especially in the tropics, and it is safe to say that much of the enjoyment of the garden depends upon them. Commanding views, overlooking terraces, spots of special interest or attraction—these are the kind of positions where seats should be placed. In the low-country they are especially appreciated when placed under the shade of trees, arbours, etc. The ground underneath the seat should be gravelled or paved, so as to avoid the discomforts of damp grass and probable intrusion of land-leeches,



A SERVICEABLE GARDEN SEAT.

ants, etc. The form of seat used may vary from a plain wooden bench to elaborate cast-iron designs. Rustic seats made of knotted branches, though sometimes much in favour, are usually most uncomfortable. The most satisfactory and economical seats in

Peradeniya Gardens consist of wrought-iron ends, with narrow strips of wood forming the seat and back. All seats, with perhaps the exception of rustic ones, should be painted, and this requires to be done at least once a year. The most suitable colour, for the low-country at any rate, is light-grey. This does not become discoloured so rapidly as other tints, and in many cases it improves, rather than deteriorate, in colour by exposure to the weather. Both green and chocolate paints very quickly become dark and dirty-looking. Zinc or other good kind should always be used in preference to lead paints.

Adornments.—Gardens in the tropics are as yet seldom embellished with such artificial adornments as statuary, beautiful vases, elaborate fountains, etc., as are met with in gardens of temperate countries. Yet other and simpler devices in the form

A KANDYAN MEMORIAL (THWAITES'), PERADENIYA GARDENS.

of arbours, arches, and trellis-covered walks on which ornamental creepers or climbers may be trained, are often adopted, and with very pleasing effect. Any adornments used should, as far as possible, take a practical form and serve a useful purpose; thus a fountain may be utilised for the growth of water plants, rearing fish, etc.; vases should be adopted for the successful display of ornamental plants; while pergolas may be made to provide cool shade as well as means for the effective display of ornamental climbers.

Pergolas.—A pergola consists of an archway over a walk, usually formed of rough stems and branches of trees, or piers of

masonry, on which climbing roses or other suitable plants may ramble. Pergolas are especially agreeable in the tropics owing to the cool shade they afford; but here the frame-work, to be durable, should be of iron (not wood) and covered with open wire-netting. A pergola which is much admired in Peradeniya Gardens comprises a number of bolt-iron arches, these being covered with different species of Aristolochia ("Fly-catching" plants), Ipomoea, Bignonia, Congea, etc. A pergola should for preference be on level ground, and not curve or twist; it may be of any length, but ought not to be less than 7 ft. wide or 7 ft. high.

Arbours.—These may be of various designs to suit circumstances. A simple and cheap form may be made of iron framework, fixed in the ground by means of sections of bamboo, which are buried in the earth and then filled with concrete; wire-netting is fastened over the iron frame-work, and on this showy climbing plants are trained. Arbours made of wood-work, with the sides formed of rustic and knotted branches, and the roof covered with shingles, are very appropriate for the hill districts. Some pretty examples of these may be seen in Hakgala Gardens and Nuwara-Eliya Park, in Ceylon.

Visitors' shelters.—No public garden in the tropics should be without some structure that will provide shelter for visitors, and this should to some extent be made to combine ornament with utility. In Peradeniya Gardens, memorial structures, erected to the memory of past directors, serve the purpose of useful shelters to the public.

Fountains are well adapted to gardens in the tropics, where, in the hot season especially, the spray or the rippling sound of water is particularly pleasant. The base of the fountain, while serving as a useful reservoir, may be turned to good effect by cultivating various water-plants in it.

Vases for out-door.—Very fair imitation of European vases are sometimes made in Ceylon of concrete, from given moulds. Good specimens of these may be seen in the Gordon Gardens, Colombo, where they are very ornamental, especially when filled with well-grown and suitable plants. The Sinhalese potters make earthenware urns on elaborate hollow pedestals, which, though liked by some people, are very fragile, and only suited to a verandah or other position under cover.

POTS AND OTHER RECEPTACLES

Pots.—The Sinhalese potters can sometimes turn out very satisfactory pots to a given pattern, but those which they make on their own initiative are usually ungainly and unsatisfactory, being either too deep and perpendicular, bulging in the middle, or disproportionately narrow at the base. Good pots should become gradually narrower from the top towards the bottom. If the sides are perpendicular, the plant with its ball of earth cannot be turned out without breaking the pot. Generally speaking, pots of large sizes should not be so deep as they are wide at the top; while, on the contrary, the depth of small-sized pots should equal or exceed their top width. A very common mistake in Ceylon gardens is to use pots unnecessarily large, for these are both obtrusive and unsuitable for the healthy growth of plants.

Hanging Pots.—These may be made in quite a variety of forms. The perforated kind, in which Maiden-hair ferns, Selaginella, etc., may be successfully grown, is perhaps the most effective. Those made of concrete and studded with pebbles are not desirable, being very heavy and devoid of porosity. Very effective are the bottle-shaped earthenware urns, around which a layer of loamy soil is held in position by means of close wire-netting; into this dainty ferns and suitable plants are dibbled, and these obtain a constant and regular supply of moisture by absorption through the urn, which is kept full of water.

Bamboo-pots.—Sections of bamboo, which may be obtained of various sizes, with the transverse division left in one end and a hole punched through it for drainage, make very useful pots for certain purposes. They are extensively used in Peradeniya Gardens for propagating work, and (larger kinds) to some extent as receptacles for growing orchids. For the latter purpose they are cut into small sections, resembling shallow pans, several holes being made in the sides and bottom for aeration and drainage.

Horizontal hanging bamboos, bamboo vases, etc.—Sections of the Giant-bamboo can be utilised in various ways for the purpose of growing ornamental plants, and also as "flower-vases" in corners of drawing rooms, corridors, etc., on temporary occasions. Their chief fault is that they are not durable, as even under cover they soon split and decay, owing to their being kept in a constantly damp condition. As horizontal hanging "pots," single joints of any large bamboo can be used very effectively. For this purpose leave the division in each end intact, cut out one side to about one-third

its diameter, and fasten a wire at each end for hanging by; a few holes should be made in the intact (lower) side for drainage.

Tubs.—Wooden tubs, either made for the purpose, or consisting of whisky or wine casks cut into two, make useful receptacles for growing large plants, as palms, etc. Such tubs should be painted green, and raised off the ground by means of bricks placed underneath. An iron handle fixed to opposite sides of the tub will facilitate the removal of the latter when necessary. If made locally by a carpenter, a simple and effective form is a square tub, slightly narrowing towards the base, fastened together at the corners by means of a couple of clamps with pegs at both ends; this can be taken to pieces or put together when desired, and when painted white, with the clamps in green, looks neat and ornamental.

Tins and metal receptacles are often employed, and sometimes successfully, for growing plants in, but their use cannot be generally recommended. Apart from their ungainly appearance, plants cannot be expected to thrive so well in these as in pots or receptacles made of a porous material. When, however, only tins are procurable and *have* to be used, a number of small holes should be driven into the bottom, and a quantity of potsherds or small pieces of brick placed over these for drainage.

Seed-pans.—These are most useful in propagating work whether for seeds or cuttings. Those usually made in Ceylon are circular in shape, and about 3 inches in depth; they vary in size, but should not exceed 12 inches in diameter, for if too large, they are less portable and are more liable to be broken.

Seed boxes are especially useful in the hill districts, both for raising seedlings under some protection from the weather, and also for pricking them off afterwards before finally planting out. The boxes should not be more than about 3 inches deep, and should be provided with free drainage.

Painted pots.—Not infrequently one sees in verandahs and at railway stations earthenware plant-pots painted in green or other striking colours. This is owing to a mistaken idea of artistic beauty, as well as to the oriental innate love of striking colours. The writer recalls a case where a well-meaning garden cooly painted all the pots in his charge a vivid pink! It should be remembered that there is nothing unsightly or unbecoming about earthenware flower-pots if kept neat and clean, and that their natural colour is the most pleasing one. Smearing them with paint destroys their porosity, which is an essential quality for the successful growth of plants.

PLANT LABELS

The utility and interest derived from a garden, especially a public or botanic garden, must to a large extent be in proportion to the use made of neat, legible labels, bearing the names or other information of the plants, trees, shrubs, etc. One important fact must not, however, be lost sight of, i.e., labels should always be made as inconspicuous as possible, for otherwise they are apt to become offensive to the eye. Small plants should as far as practicable have small labels in proportion to their size, but the largest trees need not have unnecessarily large ones. The upkeep of labelling in tropical gardens is a matter of considerable difficulty, owing partly to the attacks of termites, which destroy most forms of dead wood, and partly to the liability of metal labels being stolen or becoming corroded. Various sorts and designs of labels have been resorted to, and the following are some of the principal kinds now used:—

Wooden labels.—These are perhaps the most convenient form for ordinary purposes; they may be of any size and shape, can easily be altered to suit requirements, and are neat while they last in good condition. Those which are intended to remain in the ground should be of the hardest wood. Deal-wood labels in the tropics are only suitable for very temporary purposes, as for seeds in pans or boxes under cover; these being planed, should be rubbed over with white-lead paint, as they are then easier to write on, look best, and last longer. Large stout wooden labels, made of hard woods, as Pehimbiya (*Filicium*), She-oak (*Casuarina*), Iron-wood (*Mesua*), Palu (*Mimusops*), are extensively used at the Royal Botanic Gardens in Ceylon for trees, shrubs, etc. These are painted black, and the name printed in white zinc paint with a fine brush; the stem of the label is afterwards dipped in tar, and allowed to dry before being put out to the trees. An improvement on this form, recently adopted in Ceylon, is to stamp the name on the smoothed surface by means of steel dies, the impressions being then filled in with good white paint. Thus not only does the latter remain on much longer, but the impressions if properly made will last almost as long as the label.

Bamboo-splint labels.—A splint of hard bamboo, with one end sharpened for fixing in the ground, and the other flattened and planed, will make a cheap and serviceable label. When writing upon it, first rub some white paint on the planed surface, and use a soft lead pencil.

Lead Labels.—This is perhaps the best permanent label for trees and shrubs, and is used exclusively for such at the Royal Gardens, Kew. It consists of a piece of sheet-lead, about 3 inches long by 2 inches wide, with about ½ inch of one long side turned over to form a rim, below which 2 holes are pierced for suspending by wire. The letters composing the name of the plant, etc., are punched in with punch-type, the impressions being filled with white lead or zinc, and the surface afterwards rubbed over with an oiled rag.

Brick labels.—To obviate the destructive effects of termites, brick labels, made to a given mould, have for many years been largely used in the Botanic Gardens, Ceylon. The top has a sloping smooth surface, which is painted black, the name and other particulars being printed on in white-lead or zinc paint. Though this type of label is not durable, it is comparatively cheap and is also, of course, termite-proof.

Zinc labels.—Narrow pieces of clear sheet zinc make excellent labels for pot-plants, orchids, hanging baskets, etc., and are extensively employed in the Ceylon Botanic Gardens. These are written on with an indelible ink, which can be obtained ready-made (See *Indelible Ink*, below).

Sheet-iron labels.—Strips of sheet-iron painted black, with the name, etc., written on in white, are said to be often used for labels in India.

The "Imperishable Stratford" labels.—These excellent labels are made in England to order, of almost any size and shape required and may include any name, description or notice as may be desired; the names, etc., should be typed when sent to the manufacturer with the order. The "Stratford label" is cheap while satisfactory, and differs from the "Acme" in being made of white metal, with the raised letters in black. These labels are largely used for plants and trees in Botanic Gardens in India and Ceylon, and also throughout the West Indian Botanic Gardens. They may be kept in a legible condition by an occasional cleaning followed by a coat of paint over the raised type. In order to effect the latter, mix some paint to the consistency of printer's ink, spread this out on a smooth hard surface, pass a squeegee over the paint and then over the raised letters.

The "Acme" labels.—These are made of stout zinc, with raised letters on black ground. They are supported on stiff wire stems, or have a pair of eyes for suspending by wire or nailing to a wall.

Ivorine label.—This label, which is a composition of thick parchment-like substance, of the appearance and consistency of ivory, is now largely used in Europe for labelling pot-plants, especially orchids. It is of neat appearance, is said to be imperishable and unbreakable, and it can be written upon by either pencil or pen, the writing being indelible, except when well rubbed with soap.

Waterproof labels.—For the temporary labelling of plants, etc., as in packing them for transport, these labels are most serviceable and convenient. They are made of Manila substances, with a parchment surface and are easily written upon with ink or pencil.

Preservatives for wooden labels.—Wooden labels should always have the part that is to be fixed in the ground treated with some preservative before being put out. Various compounds of creosote, copper sulphate, carbolic acid, etc., are used for the purpose, all with more or less success. Dipping the labels in boiling tar, and then plunging them in sand, is adopted with satisfactory results in Ceylon. Mr. W. Nock, late Superintendent of Hakgala Gardens, found the following method an excellent one: Mix fine coal-dust with linseed oil until of the consistency of thick paint; boil the mixture, and while in a state of boiling dip into it the part of the label which goes in the ground. When the labels are dry, the operation should be repeated. Slightly charring, and afterwards tarring, the portion of the label to be in the ground has an excellent preservative effect.

Indelible ink for zinc labels.—A solution of platinum bichloride (one tube of 15 grains to about 1½ fluid oz. of water) forms one of the best and most durable forms of writing fluids for zinc labels. It can be used either with a steel pen or a pointed piece of palm-leaf petiole. Special writing fluids may be obtained from nurserymen, but when neither these nor the platinum are procurable, a useful substitute may be made as follows: Take one part salamoniac, 1 part verdigris, and 10 parts water; mix well together and keep in a glass-stoppered bottle; shake before using. A strong solution of copper sulphate will also answer the purpose to some extent, but is less efficient.

GARDENS AND ESTATE TOOLS AND IMPLEMENTS

Though the number of tools actually required for a garden or an estate in the tropics is not large, there are many which are not generally known and which would not only facilitate various operations in connection with garden or field work, but also prove a considerable saving of labour. The stock-in-trade of a garden coolie is often limited to a mammoty, watering-pot and a sickle, and it is only at the expense of time and labour that he gets over

STUMP EXTRACTOR.

the work with these. The quality of the work done, however, is not always as it should be. Of late years the number of useful and labour-saving implements for the farm and garden has been considerably augmented, more especially by inventions from America. Though many of these are obviously unsuited to the conditions of labour in the tropics, others are of easy application and effect a considerable saving of labour as well as of individual energy. Needless to remark, it is true economy to employ the best and most suitable tools. Though the following list includes many that are not necessary for a small garden, all are more or less indispensable in a large or public establishment, while most will also be found useful for estate work.

Name, English & Vernacular	Purpose for which generally used	Approximate price (varying according to quality.)
		Rs.
Alavango, or Crowbar	Digging holes, levering, etc.	1·50-4·50
Ant-exterminator	Fumigating ant nests : very effectual	75·00
Antipest, or Knap-sack sprayer	Fine fluid spraying	60·00
Auger. "Awakara" *S.*	Boring holes in tubs, boxes, etc.	1·30 2·50
Averruncator	See Tree-pruner	—
Axe, "Porowa" *S.* "Kodali" *T.*	Felling or cutting trees, chopping wood, etc.	1·30-4·00
Basket, garden, hand	Gathering flowers, seeds or vegetables	0·75-1·00
Basket, manure. "Kooday" *S.*	Carrying manure, soil, gravel, etc. It is carried on the head, and in the tropics usually takes the place of the wheel-barrow.	0·25-0·35
Basket, transport (large)	Removing leaves, grass, light rubbish, etc.	0 75
Bill-hook, "Wak-pihiya" *S.* "Vetu-Kathi" *T.*	Lopping branches, etc.	1·75-2·50
Branch-shears	Excellent for cutting stout branches	6·00-8·00
Brooms, "Eikel" *S.*	Sweeping paths, etc.	0·10-0·15
Do., bass, "Rata-kossa" *S.*	Cleaning concrete floors, etc.	1·65-2·00
Budding-knife	See under Knife	—
Crowbar	See Alavango	—
Dibber	Making holes for planting out seedlings, cuttings, etc.	0·50
Disc-plough	See Plough	—
Edging-iron	Indispensable for cutting turf-edges, as of paths, beds, etc.	2·00-3·00
Edging-shears	For trimming grass-edges of paths or borders	6·00-7·00
Flower-gathering scissors	Especially convenient for cutting flowers of thorny plants.	3·00-3·50
Fork, digging "Mulluwa" *S.*	Digging earth, turning manure, etc.	2·00-3·00
Do., weeding	Weeding and forking up surface soil	0·60

S=Sinhalese ; *T*=Tamil.

Name. English & Vernacular	Purpose for which generally used	Approximate price (varying according to quality).
		Rs.
Fruit-picker, "Kekka" *S.*	Picking fruit (or flowers) from branches that are not easily accessible.	1·00-2·00
Garden engine	A water-barrow with a force-pump and hose. Most useful for syringing, spraying, or watering plants over head.	150·00
Gloves, pruning	Enabling spiny plants being pruned or handled with ease.	2·50
Grind-stone	Indispensable for sharpening tools.	28·00
Grubber, various forms	A draught implement, with or without wheels, and furnished with several long broad teeth, used for cultivating or forking up the soil between crops.	12·00-30·00
Hammer, "Mittiya" S.	Miscellaneous	1·00-2·00
Do., sledge	Breaking large stones, splitting logs, etc.	0·25 per lb.
Hand-cart, "Ath-caratha," *S.*	Serviceable for removing plants, soil, manure, etc.	65·00-80·00
Hoe, Dutch or thrust	Weeding loose paths, beds, etc.	0·75
Hoe, draw	Useful for weeding, earthing up crops etc.	0·60
Do., grub	Digging, cutting trenches, etc.	1·25
Do., roller	Suitable for weeding soft soil or gravelly walks	2·00
Hone, or sharpening stone	Necessary for sharpening small tools	0·50-1·50
Knife, budding; "Pehiya," *S.*	Budding plants. A small blade, with a white handle reduced to an edge at the end.	3·00-4·00
Do., grass; sickle, or hook. "Deketha" *S.*	Used for cutting grass, rice crops, etc., instead of scythes.	0·75
Do., pruning or grafting	Pruning, grafting, etc.	3·50-4·00
Ladder, step; "Innymagga" *S.*	Essential for reaching trees, tall shrubs, etc.; indispensable in a garden.	7·00-12·00
Lawn-mower	See mowing-machine	—
Lawn sprinkler	Useful for watering lawns, flower-beds, etc.	7·00
Lawn-weeder or Daisy-grubber	Extracting deep-rooted weeds, as "Etadi"	1·50

S=SINHALESE; *T*=TAMIL.

Name, English & Vernacular	Purpose for which generally used	Approximate price (varying according to quality.)
		Rs.
Mallet, or wooden hammer.	Driving stakes into the ground, etc., also breaking up hard soil-clods.	0·50
Mammoty "Udella" *S.* "Mamoty" *T.* Kodaly, Hind	Digging, weeding, &c.; the most general implement used by labouring coolies, with the blade at right angles to the handle.	1·00
Mammoty-fork, "Pohara-mulluwa" *S.*	Digging, grubbing, stacking manure, &c.	1 00
Mattock	Cutting roots in digging or trenching	2·00
Monkey-jack	See stump Extractor.	—
Mowing-machine, chain gear	Mowing lawns ; indispensable in a large garden	90·00-150·00
Do., cog-wheel geared	Light and portable ; suitable for small garden.	18·00-30·00
Measuring tape	Measuring plots, timber, &c.	3·50-5·00
Nail extractor	Useful for opening cases, extracting nails, &c.	4·50-7·00
Oil-can, "Tel-kendiya" *S.*	Necessary for oiling mowing-machines, &c.	1·50
Peavy, or "Cant-dogs."	Levering large logs, stones, &c.	5·00
Pick (both ends pointed); Pickaxe, "Pickasia" *S.*	Loosening hard soil in trenching, picking roads, &c.	1·60
Planet Jr. cultivator	An excellent combination of tools, as drill, grubber, drill-harrow, surface scarifier, hoe, ridge, &c.	30·00
Pliers, wire-cutting	Straining, cutting wires, &c.	1·00
Plough; "Nagula" *S.*	Ploughing paddy fields or other soft ground.	2·50-20·00
Plough, disc-or harrow	Adapted for bullock draught, suited to open free soil.	125·00
"Porawa" *S.*	See Axe	—
Posthole-digger	Digging holes for fence posts or for plants.	6·50
Rain-gauge	Measuring rainfall	7·00
Rake, daisy	For cutting the flowers off dwarf-growing weeds, so as to prevent seed-production.	2·50
Rake, iron	Indispensable for smoothing the surface of seed-beds, paths, &c.	0·45-1·00
Do., hay, (wooden or wire)	Raking grass or leaves off lawns.	0·75-1·00

S=SINHALESE ; *T*=TAMIL.

Name, English & Vernacular	Purpose for which generally used	Approximate price (varying according to quality.) Rs.
Raffia. -	An excellent tying material, much used in gardens in Europe. - - - -	7d. per lb.
Reel, garden	An iron reel with stout cord; indispensable in making or maintaining straight or curved edges. -	1·75
Roller, garden -	Rolling and levelling paths, lawns, greens, etc. -	35·00-60·00
Root-puller -	Pulling out plants with long tap-roots from lawns. -	1·50
Saw, hand -	Cutting branches, pruning, etc. - -	1·50
Do., pruning	A variety of saw with a short, narrow blade. -	1·50
Do., cross-cut	Cutting logs, trees, etc. - - -	1·50
Scrape, weeding -	Used by coolies for keeping down weeds among Tea, etc. - - - - -	0·25
Scythe -	Most serviceable for cutting long grass or corn. A small pattern can be worked successfully by coolies. - - - - -	6·50
Scythe-stone	Sharpening scythes by drawing it lightly along each side of blade alternately. - -	0·80
Secateurs, or pruning scissors -	A powerful little instrument for use in one hand in pruning. - - - -	1·50-3·00
Seed-sower, fiddle-bow -	Sowing seeds broad-cast - - -	3·50
Shears, hedge-cutting -	Indispensable for maintaining neatly kept hedges, and useful for clipping bushes generally. -	3·50-7·50
Do., spring or sheep -	Popular with coolies for trimming grass verges. -	2·00
Shovel, "Iskopay-henda" *S.* -	Removing gravel, earth-work, etc. - -	2·00-3·00
Sieve, "Penaray" *S.* -	Sifting soil, etc. for potting composts. There are different sizes, from ¼ to 1 inch mesh. -	3·50-6·00
Soil stirrer, or aerator -	A central fork with revolving arms set at different angles. - - - - -	8·00
Spanner, shifting -	Adjusting nuts, lawn-mowers, etc. - -	5·00
Spirit-level -	Taking levels of plots, roads, buildings, etc. -	3·00
Spade, "Iskopay" *S.* -	Mixing or turning soil, cutting turf, earth, etc. Small light spades only are suitable for coolie labour. - - - - -	1·75-3·00
Sprayer, Knapsack -	See Antipest. - - - -	—
Stump extractor, or Monkey-jack -	An excellent implement for extracting tree-stumps or roots. - - - - -	150·00

S=SINHALESE; *T*=TAMIL.

Name, English & Vernacular	Purpose for which generally used	Approximate price (varying according to quality.)
		Rs.
Sulphurator, or powder sprayer -	Distributing sulphur or tobacco powder on plants affected with mildew or insect pests. - -	8·00
Syringe, garden; "Vasthi-kooduwa" *S.* -	Squirting or spraying water on plants, both for cleansing them and moistening the atmosphere; also spraying with insecticides - -	6·00-16·00
Tree-pruner -	Pruning tall shrubs or trees. - - -	7·50
Trowel, "Kuda-skoppay" *S.* -	Planting out small plants. - - -	0·40
Verging shears -	See Edging shears. - - - -	—
Watering-can, "Watura-kendiya" *S.* -	In daily use for watering plants in pots, beds or borders; 2-gallon capacity is a most convenient size. - - - - -	3·50-8·00
Do. rose -	Forming a spray from a watering-can; should consist of brass, with the perforated face removable by a screw. - - -	0·25-1·00
Wedges, steel. "Kooniya" *S.* -	Splitting logs, etc. - - - -	1·25
Weeding fork, hand -	Stirring surface of beds or borders. - -	0·60
Weeding fork and hoe combined -	Weeding. - - - - -	0·50-1·00
Do. hook -	Useful in weeding rocky soil - - -	0·25-0·50
Wrench -	See Spanner - - - -	3·00-7·00

S=SINHALESE; *T*=TAMIL.

CHAPTER IX.

LAYING OUT A GARDEN

How to lay out a garden is often a more vexing problem than how to manage when accomplished. But it is well to remember that however much the success of a garden depends upon its original design and apportionment, the work of laying out may be said to be a progressive one, and can hardly ever be considered to have attained a finished state. It is in this fact that much of the charm of gardening lies,—the ever-varying opportunities of effecting changes and carrying out new ideas. In giving the following suggestions, it must be remembered that no hard and fast rules can be recommended for application in all cases, as so much depends upon local circumstances, the climate, lay of the land, supply of water, labour available, etc.

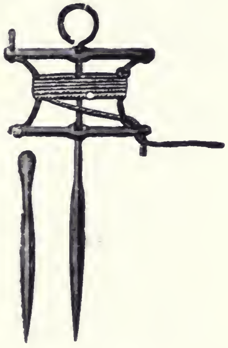
Position.—A favourable position may be said to be the most valuable asset that a garden can possess. Yet much can be accomplished, with properly directed effort and a due expenditure of money, in overcoming serious obstacles and physical advantages; thus a wilderness may sometimes be converted into a delightful garden or a most pleasurable resort. One of the first considerations should naturally be, how to transform and beautify present conditions with the least possible expenditure of time and labour. It should be remembered that it is often easier to beautify an ugly object than to remove it, and that immovable obstacles may sometimes be turned into ornaments. In commencing a garden, the mistake is sometimes made of cutting out all the existing vegetation, forgetting that this, although it may be "jungle," may not only have certain ornamental features, but will also furnish useful shade or shelter until at least other trees will have had time to grow up. Moreover, where virgin vegetation exists, a good effect may be quickly obtained by isolating it in clumps, or separating shapely trees to form solitary specimens, levelling and turfing the ground between. Details can be attended to later, and a choicer variety of plants may gradually take the place of the less desirable ones.

VIEW IN FLOWER-GARDEN, QUEEN'S COTTAGE, NUWARA ELIYA.

Water-supply.—This is an essential provision for every garden, and the laying out or arrangement of the grounds must to some extent be modified in reference to it. In the low-country of Ceylon, the garden is usually supplied from a well; up-country, a diverted stream or specially constructed channels generally meet requirements. It is important that the source of supply should be placed where the water will have the readiest access or be easiest carried to all parts of the garden. If a well, it should be somewhat concealed from view by having shrubs or trees planted around.

Preparation of the ground.—The ground must be thoroughly trenched and drained, the soil being turned over to a depth of 16 or 18 inches, and all large stones, roots or other obstructions removed. A certain amount of levelling will be necessary, it being important to obtain a uniform, even surface with a fine tilth. The texture and nutritive condition of the soil should, according to its needs, be improved by the addition of suitable manurial material. If the land be steep, it should, be formed into terraces, which lend themselves to a very pleasing effect.

Designing.—When a clear conception is obtained of what is actually desired, a sketch or diagram, however crude, should be made in order to materialise the minds' plan. The ground may thus be easily apportioned, and spaces allotted to the various purposes as may be required. This will not only save time and labour, but probably also confusion and disappointment later on. At the outset it is essential to distinguish between the front and back of the garden. The main features should first be marked out, starting with the drive or leading walk, followed by the secondary walks; these as well as the borders, etc., may easily be traced on the ground by means of string and wooden pegs.

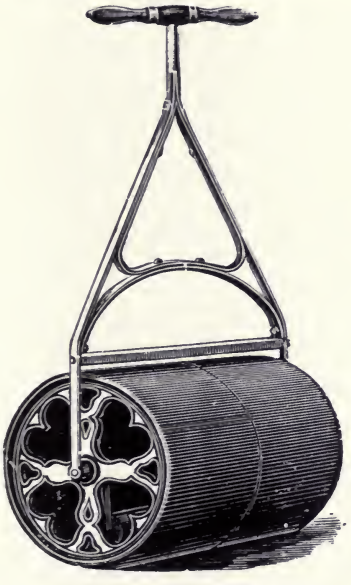


GARDEN REEL.

Planting out.—In the low-country, the first attention must be to provide a certain amount of shade or screen where such do not already exist; while at the higher elevations it is equally important to furnish shelter against strong winds by means of wind-breaks in the form of trees supplemented, when necessary, by hedges and shrubberies. The selection and planting of suitable plants to meet these requirements must, therefore, have the first consideration.

VIEW IN FLOWER-GARDEN, PERADENIYA.

Walks and Paths.—These, it has been said, are a necessary evil in a garden; yet in the tropics, as ladies especially will admit, they are very indispensable, owing to the presence of land-leeches, ants, etc., which infest the grass at different seasons. Though essentially for convenience, paths may, however, be made to contribute to the general effective appearance of a garden. But they should not be made for appearance alone, and only where actually required. Their width should depend upon the importance of their position, a breadth of 4 to 5 ft. being a good average size for a small garden. The main walks should be wide enough to allow of at least two or three persons walking comfortably abreast, and in the more extensive gardens or parks they may well be from 10 to 15 ft. in width. The Long Walk at Windsor Castle in England is about 50 feet wide and two miles long. In large or public gardens in the tropics, where walking is often an exertion, the principal walks should be about 12 feet wide, as in Peradeniya Gardens, and be open to carriages and motor cars. It is an invariable custom with the garden cooly in Ceylon to make the paths absurdly narrow and numerous, his object usually being to make a garden of paths, rather than of flower-beds, borders and lawn. In making paths, a good foundation and drainage are essential. Having removed the surface soil, place a layer of drainage material (stones, broken bricks, etc.) in the bottom; cover this with coarse binding gravel, and roll or stamp thoroughly, watering well meantime; finish off with a layer of finer gravel firmly beaten down. It is often advisable in the tropics, owing to the heavy plumps of rain so frequently experienced, to make a small parallel side-drain on either side of the path, below the level of the latter, leaving a strip of turf not less than 12 inches wide between the drain and the path; small sloping channels should at intervals lead into the side-drains, so as to facilitate the escape of surface water during heavy rainfalls. Paths should not be of too steep a gradient, or they will be liable



A SERVICEABLE GARDEN ROLLER.

to get washed away by heavy rains. This can be obviated on steep slopes by introducing graceful curves or flights of easy steps; these will also render the path pleasanter to walk upon. To maintain the paths in a clean and even condition, free from weeds and hollows, is a matter of the first importance. The grass verges should always be cut evenly and straight, not notched at the edges, and this can best be done by edging shears. Weedy paths, with

ANOTHER VIEW IN FLOWER-GARDEN, PERADENIYA.

crooked margins, give an unfavourable impression of their surroundings, however well-kept these may be.

Drains and Culverts.—Provision for the escape of waste or excessive rain water must have early attention, for even the most absorbent and best drained soils are liable to be flooded, or, if on a slope, to serious slips or wash-away by the heavy showers characteristic of a tropical climate. Paths, roads, terraces, etc., must

EDGING SHEARS

therefore have ample surface drainage; good culverts, with a cemented and sloping foundation, should be made wherever the water is liable to accumulate. It is advisable to build at the higher end of each culvert a silt-pit; this will not only collect the washed-away gravel, which may again be used on the paths or roads, but also prevent leaves and rubbish from entering and choking the culvert. Small surface channels, as inconspicuous as possible, should be made wherever a surface-wash is liable to occur, whether in the flower or vegetable-garden, or elsewhere.

FLOWER GARDEN

Background.—Though a special background is not always necessary, its presence as a rule does much to enhance the beauty of the flower-beds or lawn in the foreground. Thus a bank of mixed tall foliage and flowering shrubs serves the purpose to advantage, the taller kinds of plants being placed at the back, and gradually smaller ones towards the front. In this way all the plants, when they have grown up to form a sloping bank, will be seen at once from the front. In the case of borders which are to be seen from both sides, the taller plants should of course, be planted towards the centre.

SHEEP SHEARS, GENERALLY PREFERRED BY COOLIES FOR CUTTING GRASS EDGES.

Bedding, Grouping, etc.—As a general rule, either flowering or foliage plants look most effective when massed separately in large beds or groups, or in rows, circles, or irregular patches as component parts of these. Frequently, however, the effect is more pleasing by mixed planting according to a definite colour arrangement, the beauty of many species being thus enhanced both by contrast and harmony with surrounding flowers or foliage. The beds or borders used should be of simple designs, like the

square, oval, circle, and rectangle. A large circular bed, formed of a sloping mass of harmonious colours, from centre to margin, is always a pleasing sight. Beds of elaborate designs, with many points and angles, should be avoided; they involve much more labour than simpler forms, and it is impossible to find plants which can be adapted to very small nooks and corners. An exception to this rule may, perhaps, be made in favour of the star-shaped bed, which, when space permits and suitable plants are available, can be made very effective. It should be remembered that the beauty of a garden does not consist in fantastic designs and serpentine wriggles. In order that the beds and borders may be maintained in a proper condition and be admired, they should not

ANOTHER VIEW IN FLOWER-GARDEN, PERADENIYA.

be placed too closely together; sufficient space must be left to enable the coolies to work them, and for spectators to walk comfortably between them. The ground-work should, as far as possible be of lawn, which if well-kept will always afford the most beautiful setting. Plants of even mediocre quality will present an effective appearance when set in a well-kept green sward. If the grounds be large enough to admit of it, the grouping of the larger plants, as palms, shrubs, etc., in what is called the "natural style" has much to recommend it. In this the object is to group the plants harmoniously, according to their habit, colour of flowers or leaves, forming

them into isolated clumps to suit the contour of the ground. Keeping this idea in view, irregular clumps planted at the bends and curves of walks or drives may be made to present a pleasing effect. It should, of course, be remembered that violent contrasts of colour are at all times objectionable. In order to enhance the effect of either beds or borders, it is well as a rule to raise the soil well in the centre.

A USEFUL TRIO.

Massing and isolating Clumps.—As has already been said, many plants which are comparatively inconspicuous individually, may present a striking effect when planted in masses, whether they be "foliage" or "flowering" plants. Thus, a very ornamental display may be made by isolated clumps of a suitable combination of foliage plants, such as Palms, Heliconias, Cannas, variegated grasses, Caladiums, variegated Pine-apple, etc. These have also the recommendation that, when once planted, they do not require much attention or frequent renewals.

Ribbon Borders.—Although planting in lines or rings is as a rule, to be avoided, yet a ribbon border in which a suitable blending of colours is obtained in this fashion, has a pleasing effect. This is all the more striking when carried out on a fairly long and broad stretch of border or even large bed; but, as already stated, it should be remembered that violent contrasts of colour, which are here liable to occur, should be avoided.

Foliage plants for colour effect.—In a garden where a continuous rather than a periodical display is aimed at, free use must be made of striking foliage plants. These may, in fact, be arranged so as to present by their striking colours an effect similar to flowering plants. It is to such foliage plants that much of the fine effect of the floral section in Peradeniya Gardens, Ceylon, is due. Flowering plants should, however, find a place when suitable kinds are obtainable, and it is well to remember that these make the most striking display when each kind is grown by itself, instead of

mixed with others. Unfortunately, in the tropics the flowering period of many of the most showy plants is of so short a duration that they are not suited to situations where a continuous ornamental display is desired. In gardens at the higher elevations, however, a beautiful display of flowering annuals may be obtained throughout the dry season, while various bulbous plants and others present a showy appearance during the intervening period.

Ferneries.—See under *Ferns.*

AN EFFECTIVE GROUP OF FOLIAGE PLANTS, PERADENIYA GARDENS.

Banks or Double-cuttings, which usually occur in a garden, may be so treated as to render them interesting in themselves, and to greatly enhance the beauty of their surroundings. Where sufficiently shaded, they may be occupied by a pleasing variety of ferns, small foliage and flower plants, which should be planted in pockets filled with rich humous soil. If the ground be much exposed, it may be either covered with smooth turf, or planted with showy forms of sun-loving creepers. An excellent example of a charming bank of the former type may be seen skirting the entrance drive to Hakgala Gardens, under the shade of Cupressus trees.

Ornamental Water—Water in almost any form adds greatly to the attractiveness of a garden, park or pleasure ground. It should be introduced, if practicable, when not already present, and advantage should be taken of the opportunity it affords of lending distinctive charms to the vicinity. As a rule an expanse of water is most suitable in a hollow, in imitation of nature, and should not

A HANDSOME GROUP OF FOLIAGE PLANTS, PERADENIYA GARDENS, COMPRISING *Chrysalidocarpus palm, Heliconia insignis, Arundo donax* (VARIEGATED GRASS) AND PURPLE-LEAVED CANNAS.

be too close to the dwelling house. An island with an irregular outline and planted with suitable trees, shrubs, and perennials has a pleasing effect, so long as it does not look too artificial. The water margins should not be too thickly planted with trees or shrubs, and, in order to provide a mirror for the reflection of the banks, at least two-thirds of the water surface should be kept clear of foliage

EDGING IRON.

or other vegetative growth. Rippling streams or cascades in a garden have a charm all their own, and should be introduced whenever possible.

LAWNS: THEIR MAKING AND UPKEEP

It has been well said that a lawn is to a garden what a background is to a picture. An expanse of smooth and green sward has a special and distinctive charm; it enhances the beauty of surrounding objects, whether they be trees, shrubs, or flower-beds, and forms a most pleasing adornment to a bungalow or dwelling house. In making a lawn, it is essential that the ground be first properly prepared, the surface being thoroughly dug or trenched and uniformly levelled, all stones, roots and similar obstacles being raked off. If the nature of the ground requires it, provision must be made for drainage and for the escape of excessive rain-water, but if the ground be undulated, or the sub-soil of a gravelly nature, artificial drainage may not be necessary. If the soil be very poor, the turf is liable to become patchy in dry weather; therefore a layer of good soil or compost should be laid on the surface. In order to ensure a uniform or level surface, pegs should be driven into the soil at the extreme points, and intermediate pegs at regular distances between these; the desired level or gradient from peg to peg can best be obtained by means of a spirit-level and a long piece of wood having a straight edge.

Turfing.—Laying turf by hand is the quickest and, for the low-country the most satisfactory method of forming a lawn, sowing seed being generally somewhat precarious. The turves should be obtained from close-grazed pasture land, and cut as nearly as possible of uniform thickness. This is best done by a spade, or better still by the implement turf-cutter,* though for ordinary purposes a mammoty will answer the purpose, and this is the easiest tool for coolies to handle. The turf should be used

* In England a horse-drawn turf-cutting machine is sometimes used, which, it is said, is capable of cutting at the rate of ½ an acre of turf a day.

fresh, and the soil worked in between them to fill up all interstices, finally sprinkling some fine soil on the surface and brushing it in. The turves being beaten down into position with a flat heavy piece of wood, the whole surface should be thoroughly rolled over and watered.

Turf grafting.—In the case of a large area, or when turf or labour is scarce, economy of both may be effected by laying the turves, or portions of these, a foot or more apart, sinking them

THE LAKE, PERADENIYA GARDENS

level with the surface. The intervening space may be sown with seed, or grass roots may be dibbled in, the whole surface being then watered and rolled.

Other Methods.—Another economical and successful method of forming a lawn is, having brought the soil to a fine tilth and uniform level, to obtain the best grass roots from a close-grazed pasture land (choosing wet weather for the purpose), and dibble these in the ground a few inches apart, afterwards rolling and watering the surface. A method which is said to be successfully adopted in Northern India is described thus: "Pull up a quantity of grass by the roots, chop it tolerably fine, mix it well in a compost of mud of

VIEW IN HAKGALA GARDENS, CEYLON,

about the consistency of mortar, and spread this out thinly over the ground where the lawn is required." This, however, would not be suited to wet climates, where a single heavy shower might wash the preparation away.

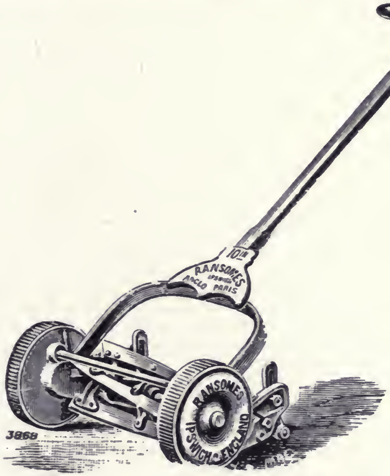
Lawns by Seed-Sowing.—Although lawn-making by sowing seed is not usually satisfactory in the low-country, at higher elevations, where certain English lawn-grasses will thrive, it is often

MOWING LAWNS, PERADENIYA GARDENS.

very successful, as may be seen in some gardens and greens at Nuwara Eliya, Ceylon. In the low-country, however, a uniform green sward can seldom be obtained by sowing seed, owing partly to the rapid growth of weeds, prevalence of bird and insect pests, and the liability of the seeds to being washed away by heavy rain, or exposed to severe drought. Whichever method is adopted, the margins of walks and flower beds should always be laid with a continuous belt of turf, even if it be but a foot in width.

THE GREAT LAWN, PERADENIYA GARDENS.

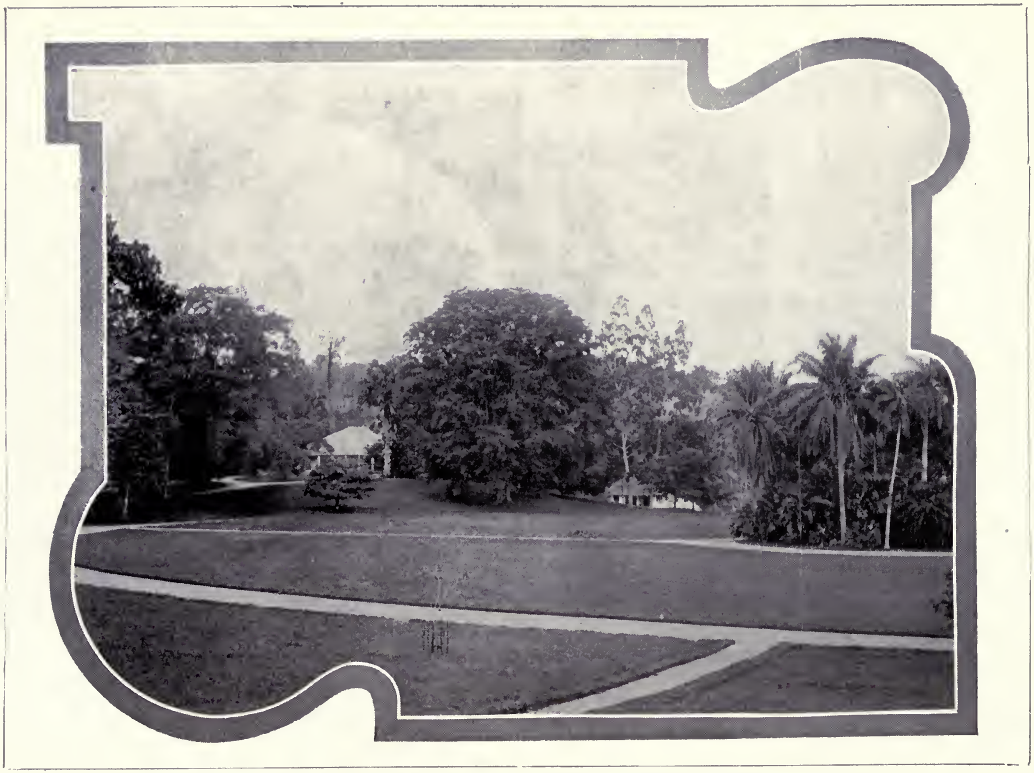
Up-keep of Lawns.—The success of a lawn depends upon its proper up-keep; it should as far as practicable be kept free of weeds, mowed at brief intervals with a mowing machine, and never allowed to produce seed-stalks or wear a neglected appearance. A heavy roller should be used frequently, but not when the ground is either very wet or unusually dry. A mower should not be employed until a firm green sward has been formed, the grass at first being cut by a scythe or sickle, so as to encourage the roots to spread. When lawns become impoverished, a top-dressing of a rich compost, consisting of fine loamy soil and well-rotted manure should be



A COG-WHEEL GEAR MOWER

given, this being raked well in, and the surface afterwards rolled and watered. The dressing should not be sufficient to completely hide the grass from view. An application of artificial manure may be given when needed, nitrate of soda (at the rate of about one lb. per 40 square yard) being considered very good for the purpose. Other suitable stimulants are a mixture of 3 lb. basic slag and 2 lb. kainit per 40 square yard, or $\frac{3}{4}$ lb. sulphate of ammonia for the same area.

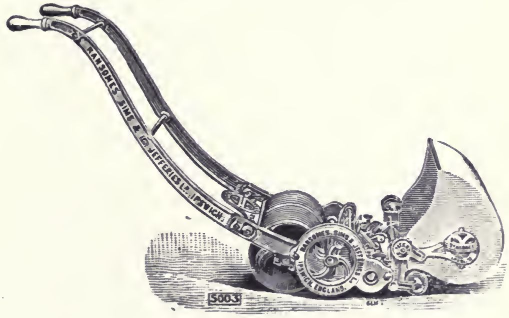
Enemies of Lawns.—Not the least formidable of these is the pernicious termite or white-ant, whose "nests" should be looked for and destroyed at the earliest signs, either by digging them out, or pouring poison, or pumping poisonous fumes, down their crevices. The "ant-exterminator" (see under *Insect Pests*) is one of the best means yet discovered for destroying them. Certain



THE GREAT-CIRCLE LAWN, PERADENIYA GARDENS.

weeds are particularly partial to lawns, one of the worst being the "Elephant's foot" (*Elephantopus scaber*). These should be dug up by a spud or "daisy fork;" or the plants may be killed by dropping poison into their centre. Worm-casts in lawns are particularly objectionable. Yet their presence might be regarded as beneficial rather than otherwise, for worms are the means by which nature manures the grass and drains the surface; moreover, their presence is a sign of good soil, as their food consists of decayed vegetable matter, which after being digested is ejected in the form well known as worm-castings. Watering the soil with Vaporite, or with a weak solution of ammonia or lime water, will cause the worms to come to the surface, when they should be collected and destroyed.

Suitable grasses for lawns.—As to what constitutes the best grasses for lawns, much depends on climate and local conditions.



CHAIN-GEAR LAWN MOWER.

The "Doob-grass" (*Cynodon dactylon*) is a favourite for dry regions, as on the plains of India, while the Love-grass or "Tutteri" (*Chrysopogon aciculatus*) forms excellent turf in the moist low-country, in spite of the objection to it when allowed to flower and seed, owing to its sharp hooked awns which adhere to and penetrate one's clothes. The ordinary self-formed turf on the lawns in Peradeniya Gardens has been found to consist chiefly of the following:—*Chrysopogon aciculatus* ("Love-grass" or "Tutteri"), *Ischaemum ciliare* ("Rat-tana"), *Setaria glauca* ("Kawulu"), *Panicum sanguinale*, *Sporobulus diander*, and the clover-like *Desmodium triflorum* ("Hin-undu-piyali"). Under the shade of trees the principal turf-grasses are *Paspalum conjugatum*, *Panicum trigonum*, *Oplismenus compositus* and *Apluda aristata*. The grass known locally as the "Barbadoes Sour grass," and in the Philippines as "Bitter grass" (*Paspalum conjugatum*), is an

introduced species from the West Indies; it has become completely naturalised in Ceylon, being specially adapted to shady situations, and when kept closely cut forms very fair turf. Certain English grasses will thrive at the higher elevations in well-prepared ground, and grass seed mixtures adapted for particular purposes may be obtained from seed-merchants in Europe or Australia.

HEDGES AND BOUNDARIES

For several reasons a garden in the tropics should be enclosed by a hedge or fence, that is if exclusion of cattle and other vermin, shelter from wind, and privacy be considered essential. Well-kept hedges are ornamental as well as useful; they form protective

LAWN-SPRINKLER

boundaries, shut off private quarters, divide portions when necessary (as the Kitchen-garden from the Flower-garden), or conceal unsightly parts. A large number of plants are adapted for forming hedges, and the suitability of each kind depends upon the purpose and locality for which it is required. For an effective hedge of coloured foliage, such plants as Acalypha, Croton, Panax, Pisonia, Cordyline, etc., either mixed or singly will supply all that can be desired; whilst for a hedge of flowering plants, different varieties of Hibiscus, Ixora, Poinsettia, Thunbergia erecta, etc., make a striking display. In many cases a hedge may be formed by simply planting cuttings where they are required to grow. It is always advisable to give a hedge a good foundation, i.e., a trench dug deep and filled in with good soil; otherwise gaps or unevenness of growth are likely to occur. When a hedge has to answer the purpose of a barrier, a good plan is to run a few strands of barbed wire

along the centre; or, if the wire-fence is already in position, the hedge may be planted (or sown) by its side; otherwise the fence may be beautified or concealed by growing some ornamental climbers over it. An excellent barrier hedge may be formed by means of some formidable prickly plant, as Yucca, Agave, etc.

HEDGE-SHEARS

Certain plants, as the "Madras-thorn," form the best hedge when started from seed sown *in situ*. In trimming a hedge, it should always be remembered to keep it narrower at the top than at the bottom, otherwise it becomes bare and leafless near the ground.

Selected Hedge-plants for the Low-country.

Name	How propagated	Remarks, approximate height, etc.
Acacia sphaerocephala "Bull's horn Acacia."	S	Slow-growing, 4-6 ft.
Acalypha, different varieties.	C	Quick-growing, 10-15 ft., coloured foliage.
Agave americana variegata. "American Aloe."	S & Su.	Slow-growing, 5-6 ft., ornamental and barrier.
Aralia filicifolia.	C	Quick-growing, 6-8 ft., handsome fern-like foliage.
A.—Guilfoylei.	C	Quick-growing, erect, variegated, serrated foliage.
Bambusa nana. "Dwarf Bamboo"	Div.	Slow-growing, 6-8 ft.
Brunfelsia, see Franciscea.	—	
Casuarina equisitofolia. "She Oak"	S	Moderate grower; height as desired.
Clerodendron aculeatum. "Wild Coffee"	S	Rather slow grower, 5-8 feet.
Croton (*Codiæum*), different varieties.	C	Do. do. do.
Duranta Plumieri. Duranta.	C & S	Moderate grower, 8-15 feet.
Ehretia buxifolia. "Ceylon Boxwood"	Do	Slow-growing, 3-4 ft. or dwarf, suitable for edgings.
Eranthemum maculatum, and other varieties.	C	Quick-growing, 6-8 ft., variegated and coloured foliage.
Euphorbia Antiquorum. "Daluk" S.	C	Quick-growing, 8-15 ft.; barrier, juice poisonous.
E.—Tirucalli. "Milk-hedge," "Nawahandi." S.	C	Quick-growing, 6-8 ft.; used as boundaries for paddy fields.
Flacourtia Ramontchii. "Uguressa."	S	Slow-growing, 6-8 ft., thorny, good barrier.
Hæmatoxylon campechianum. Logwood.	S	Slow-growing, good barrier.
Hibiscus rosa-sinensis, varieties. "Shoe-flowers."	C	Quick-growing, fine-flowering; 8-10 ft.
Jatropha Curcas. Physic-nut; "Rata-endaru" S.	C	Quick-growing, 5-6 ft.
Justicia gendarussa.	C	Fairly quick grower, 3-4 ft., bushy
Malpighia glabra. "Barbadoes Cherry."	C & S	Slow grower, 3-4 ft., or dwarf, suitable for edgings.
Murraya exotica. (Limonia.)	S	Slow grower, 6-8 ft.
Panax fruticosum.	C	Quick grower, 6-8 ft., handsome foliage.
Pithecolobium dulce. "Madras thorn"	S	Moderately quick grower; good barrier, thorny; 6-15 ft.
Pedilanthus tithymaloides.	C	Moderate grower, 3-4 ft.
Phyllanthus myrtifolius. "Ceylon Myrtle."	S & C	Slow grower, 5-6 ft., dense foliage
Punica granatum. Pomegranate.	Do.	Quick grower, 6-8 ft,
Triphasia aurantiola. "Sweet Lime."	S	Slow grower, 4-5 ft., good barrier

S=seed; C.=cuttings Su=suckers; Div.=division.

For Up-country.

Name	How propagated	Remarks, approximate height, etc.
Acalypha marginata "Copper-leaf."	C	Quick grower, 5-6 ft., large ornamental leaves.
Berberis Fortunei. Chinese Berberis.	S	Slow grower, 3-4 ft.,
Caesalpinia sepiaria.	S	Quick grower, 5-6 ft.
Cestrum fasciculatum.	S or C	Fairly quick grower, 6 to 8 ft., fine-flowering.
Collelia cruciata.	S	Slow-growing, very thorny
Cryptomeria japonica. Japanese Cedar.	S	Slow grower, 6-10 ft.
Cupressus Lawsoniana. Cypress.	S	Moderately quick grower, 6-12 ft.
Duranta Plumieri. Duranta.	S or C	Do. do. do.
Francisea bicolor (*Brunfelsia uniflora*).	Do	Slow grower, 4-6 ft.
Frenela rhomboidea. Conifer.	S	Do. 6-8 ft.
Furcræa gigantea. Mauritius Hemp.	S or Su.	Fairly quick grower, 6-8 ft. suited for boundary.
Habrothamnus elegans.	S or C	See *Cestrum.*
Libonia floribunda.	C	Slow grower, 2-4 ft., ornamental.
Spiræa peruviana.	S or C	Rather slow grower, 4-6 ft., fine-flowering.
Tecoma capensis.	Do	Do. do. do.
Ulex europea. Gorse ; furze.	S	Slow grower, good barrier ; ornamental, 5-6 ft.

For the Dry Region.

Name	How propagated	Remarks, approximate height, etc
Agave american.	Su. or S	See above.
Carissa Carandas. "Maha-karamba," S. "Perunkila" T.	S	Shrub or small tree, thorny.
Dichrostachys cinerea. "Andara" S. "Vidattal" T.	S	Slow grower, 5-6 ft., thorny.
Duranta Plumieri. Duranta.	S or C	See above.
Euphorbia Antiquorum. "Daluk" S.	C	Quick-growing, 8-15 ft.; barrier, juice poisonous.
E.—Tirucalli. "Milk-hedge."	C	Do.
Jatropha Curcas. Physic-nut.	C	Do.
Pandanus Zeylanicus. "Akeyiya." S.	S or Su.	Slender stems, 6-7 ft., boundaries of paddy fields.
Parkinsonia aculcata. "Jerusalem Thorn."	S	Quick grower, 5-6 ft., thorny, good barrier.
Pithecolobium dulce. "Madras Thorn."	S	See above.

S=seed ; C=cuttings ; Su=suckers ; Div.=division.

PLANTS SUITABLE AS EDGINGS FOR PATHS, BORDERS, ETC.

FOR THE LOW-COUNTRY.

Name	How propagated	Remarks, approximate height, etc.
Alternanthera, several varieties.	C	½-1ft. Foliage bronze or greenish yellow ; quick-growing.
Amaryllis (*Hippeastrum*), several varieties.	Bulbs	Large showy flowers ; 12 to 16 in. high.
Anthericum liliastrum variegatum.	Div.	½-1ft ; long, narrow, variegated leaves.
Caladium Humboldtii (*C. argyrea*).	Tu.	10 in. Small leaves, prettily variegated.
C.—bicolor. Several other varieties.	Tu.	1 ft. Leaves pink and green.
Caralluma campanulata.	C	Dwarf, leafless plant, with square stems.
Casuarina equisitifolia.	S	A tree, but can be kept low by pruning young.
Malpighia coccinea.	C or S	Shrub, adapted for keeping low like boxwood.
Ophiopogon intermedius.	Div.	Grass-like ; suited to shady places ; 1 ft.
Phalaris arundinacea.	Div.	Variegated grass, 6 in., likes shade.
Stapelia grandiflora.	C	Small succulent plant.
Zephyranthes carinata. "Rose Amaryllis."	Tu.	8 to 10 in.; Fl's large, bright rose.
Z.—tubispatha.	Tu.	Do.; flowers white.

FOR UP-COUNTRY.

Name	How propagated	Remarks, approximate height, etc.
Alternanthera, several varieties.	C	See above.
Amaryllis (*Hippeastrum*).	Bulbs	See above.
Anthericum liliastrum	Div.	See above.
Boxwood (*Buxus sempervirens*).	C	Slow-growing shrub with small oval leaves.
Caralluma campanulata.	C	See above
Cyrtanthus Mackenii. "African Bride."	Tu.	1 ft. Fl's Creamy white
Echeveria metalica. "Oyster Plant."	Div.	3 in. Small succulent rosette-like plants.
Golden-feather (*Pyrethrum aureum*).	S or C	6-8 in. Handsome yellow foliage.
Santolina chamaecyparisus. "Cotton Lavendar."	C	1 ft. Foliage light grey, strongly scented.

CONSERVATORIES, PLANT-SHEDS AND GREEN-HOUSES

The object of a plant-house in the tropics is not, except in the hills, to protect plants from the cold, but from the fierce sun's rays and strong winds, while also maintaining a uniform, cool and moist atmosphere. Though combining the purposes of shelter and shade, however, plant-houses must be constructed so as to also allow of a free circulation of air and admit sufficient light for the growth and health of the plants. Such structures when suitably built and tastefully filled with well-grown and choice plants, form a most delightful and cool retreat during the heat of the day, and afford the essential conditions for the successful cultivation of a vast number of showy tropical shade-loving plants.

A modest structure of bamboos, covered with palm leaves, may for a time answer the purpose of a plant-house, and last for about a couple of years. But a more substantial and lasting building affords greater satisfaction, and may have its framework composed of teak or other hard wood, or better still of iron. The iron Octagon Conservatory in the Royal Botanic Gardens, Peradeniya, Ceylon, might be taken as a model of an economically built and eminently satisfactory type of a tropical plant-house. The upright supports consist of old rails, 12 ft. long, 3 ft. of each rail being buried in concrete. The top is flat for a distance of 12 ft. from the circumference, and rests on horizontal rails with iron bars placed transversely at distances of a few feet. In the centre rises an octagon "dome," the upright rails forming the pillars of which, being 21 ft. long, with 4 ft. buried in concrete. The circumference of the house is outlined by a half-brick wall 3 ft. high, the outer edge of which is flush with the iron posts. The whole structure is covered over with a 3 in. mesh wire-netting. Over the flat tops are placed split-bamboo, strung together like tats and tarred. The handsome evergreen climber *Passiflora laurifolia* is planted around the house and trained on the wire-netting of the upright portions, forming a useful and effective screen. The interior is occupied with graduated plant-stages on one side, and a broad sloping border on the other; here numerous shade-loving species thrive to perfection; all the paths and stages are concreted.

In building a conservatory, it is important that the site should be somewhat higher than the surrounding level, so as to admit of proper drainage being secured. Shade or screen for plant-houses

VIEW IN INTERIOR OF OCTAGON CONSERVATORY, PERADENIYA GARDENS.

may be effectively provided by means of suitable evergreen climbers with small leaves. These should not, however, be permitted to grow over the roof, as they would thus interfere with the light and ventilation, rendering the interior unsuitable for the growth of plants. In India, a layer of grass placed on the roof is often used for shade, while in Ceylon coir-netting is generally employed for the purpose. In the hill districts, the growing of tender tropical plants can usually be carried on only by means of a greenhouse or at least a well-protected or glazed verandah. A green-house may be easily heated by a flue passing from a fire and stoke-hold outside to within, and then under the plant-staging. An excellent green-house, built on this principle, may be seen in Hakgala Gardens, Ceylon.

Propagating frames.—Glazed frames are most useful adjuncts to up-country gardens. The frames may be varied in size according to requirements, and should always be movable, i.e., not fixtures. Bottom-heat may be provided for a propagating frame by means of a hot-bed made of fermenting horse-dung, the latter being heaped in a deep pit, covered over with a layer of fine soil, and the glazed frame placed over it.

CULTIVATION OF POT-PLANTS

The successful cultivation of the choicer kinds of ornamental plants in pots is a branch of horticulture which demands special care and a certain amount of skill. A knowledge of the requirements of each class, gained by observation of their growth and general progress, is the most valuable guidance in the matter. An important condition, both for the health and appearance of the plants, is cleanliness; therefore the foliage should be frequently syringed, or sponged with soapy water if necessary, and the pots scrubbed to prevent the growth of moss or lichen upon them.

Potting plants.—The essential requirements for this operation are clean earthenware pots, a suitable compost of soil, and broken pieces of potsherds or porous tiles, etc. Commencing with the drainage of the pot, a crock (piece of potsherd) is placed, concave side down, over the hole in the bottom; around and over this are placed more crocks, finishing with smaller ones, the drainage being then about an inch deep; over this should be laid some moss or coir fibre to prevent the soil clogging the drainage. A layer of the potting compost being then filled in, the plant is placed in the centre, the soil being filled in around it and pressed firmly. A space of about $\frac{1}{2}$-inch from the rim should be left for the purpose of

holding water when the plants are watered. It is usual at Peradeniya Gardens to cover the surface of the soil in the pots with a layer of small pieces of brick or sandstone, which has the effect of preventing the soil from being washed out in the course of frequent waterings, while also checking the evaporation of moisture. After the plants are potted, a copious watering is given, and the plants are kept for a few days in a dark room or under heavy shade. A very common error on the part of native gardeners is to use pots many sizes too large; these are not only ungainly, but also less suited to the health of the plants growing in them. Plants look and thrive best in pots which are in proportion to their size.

The proper time for potting.—This should be determined by the progress of the plants and the condition of the soil, rather than by any fixed seasons. Generally speaking, the best time for the purpose is when the plants are commencing their more active periods of growth, which usually occur at the commencement of the monsoon rains. The necessity for re-potting a plant may be ascertained by turning it out of the pot and observing the state of the roots, soil, or drainage. "It is a standing rule," said Sir Joseph Paxton, "with experienced horticulturists that no plant should be allowed a larger pot till the one in which it is growing is filled with fibrous roots." Frequently, however, before the pot is filled with roots the soil becomes sodden or impoverished, with the roots in an unhealthy state, and the plant unable to make normal growth. This condition is especially liable to be induced by the frequent watering necessary in the tropics, and when it occurs the soil requires to be entirely removed, and replaced with a suitable potting mixture. (See below).

Drainage of Pot-plants.—There is no point of greater importance than the drainage. In the great majority of cases when plants are sickly, the cause is to be found in imperfect drainage, in consequence of which the soil becomes sodden and sour. Whenever this condition is suspected, the plant should be gently turned out, and the drainage repaired as at first done, renewing the soil also if necessary.

Soil of Potting plants.—The ideal soils for potting most plants should consist of rich loam, leaf-mould and silver-sand, made up in various proportions to suit the plants in hand. A peaty soil is considered specially suitable for ferns and plants of the Rhododendron and Azalea family (though these may also thrive in loamy soils), while

palms and most foliage plants prefer a rich loamy soil. A good potting soil for general purposes is obtained from the turf of pasture land; when used it should be in a well-decayed and friable condition. The turf should be procured long before it is required, and stacked (with the grass-side down), incorporating with it layers of cattle manure and leaf-mould. Where it is difficult to obtain turf or loamy soil, a good substitute may be made by a mixture of well-decomposed coir dust, leaf-mould, and well-rotted cattle manure. In Colombo, for instance, this is practically the only kind of soil procurable for potting plants.

Worms, eelworms, centipedes, etc. in pots.—Vaporite is an excellent remedy for disposing of these, and should be in the possession of everybody who grows plants in pots. It is a simple but effectual preparation, and may be applied in a solution with water (say a table-spoonful to a gallon of water), or merely sprinkled dry on the surface of the soil before watering. Where vaporite is not at hand, lime-water or soot-water may to some extent answer the purpose. In obstinate cases it is recommended to stop the hole of the pot with clay for a few hours, so that the whole of the soil may become saturated with the solution.

VERANDAH GARDENING

An essential feature of horticulture in the tropics is what may be called verandah-gardening, which in many cases covers the entire gardening operations of a householder. Nothing brightens the appearance of a bungalow so much as a verandah furnished with well-grown and choice plants, and these may be considered as indispensable to a verandah as the latter is to a bungalow. As window-gardening is now a prominent feature in many European towns, being publicly supported and supervised by tasteful women, the attention of municipal authorities in the tropics might well be directed to the advisability of encouraging verandah gardening in towns. The successful growth of plants in a verandah will, of course, depend very largely on aspect and situation. Many beautiful foliage plants which become stunted or scorched by the sun on the south side of a bungalow, will thrive luxuriantly in a shady north verandah. Ferns generally are best suited to a shady northern aspect. It is often advisable, however, to change the plants, as may be gauged by their indifferent or unevenly developed growth, from north to south, or vice versa. All plants growing in a verandah should be turned round frequently in their position, so as to equalise the effects of the light, otherwise their growth will be one-sided.

Overcrowding of the plants should always be avoided, for space as well as cleanliness is essential for their well-being. The foliage should be syringed frequently, and all dead, sickly, or superfluous growth removed. The pots or tubs should not be ungainly in size, or of grotesque appearance, and should always be raised off the ground and placed on neatly arranged or concealed bricks.

Drawing-room plants.—Everybody experiences at one time or another the difficulty of keeping plants in good condition in a room, for, however carefully tended, these sometimes sicken or become discoloured. This may be due to insufficient sun-light, which may be obviated to a large extent by placing the plants out of doors at night and early part of the day, as well as on all occasions when not required; frequently, however, excessive watering is the cause of failure (See *Watering pot-plants*, below). Whenever practicable, the plants should be placed out of doors in the rain, in a shady corner, in order to keep their foliage clean and fresh.

Selection of plants for Verandahs.—Certain plants are more adapted for growing under cover than others. Thus in a selection for the low-country, foliage plants such as Ferns, Begonias, Palms, etc., should predominate; while for the higher elevations flowering annuals or perennials, hardy ferns, etc., are best adapted. The following indicate the kinds chiefly suited in either case. For the Low-country:—Feathery palms, such as *Chrysalidocarpus*, *Caryota* ("Kitul"), *Ptychosperma*, *Martinezia*, *Phœnix* (Date kind), and *Cocos* (Coconut kind); Fan-palms as *Livistona australis*, *L. rotundifolia*, *L. Chinensis*, *Thrinax*, *Latania*, and *Sabal*; also *Anthuriums*, *Alocasias*, *Begonias*, *Marantas*, *Ferns*, *Caladiums*, *Ophiopogon*, etc. For Up-country:—*Pelargoniums*, *Geraniums*, *Petunias*, *Begonias*, *Primulas*, *Gloxinias*, *Cinerarias*, *Chrysanthemums*, *Fuchias*, *Cyclamens*, *Gesnerias*, *Streptocarpus*, *Bouvardias*, *Adiantum* and other ferns, etc. (See *Selections for Up-country*).

WATERING OF POT-PLANTS

Watering is one of the most important operations connected with the cultivation of plants in pots, for a deficient or excessive supply of water is a most frequent cause of languid growth or death of such plants. To know just the proper amount of water that is most beneficial to a plant requires judgment, and can only be learnt by observation of the requirements of each species. In watering plants, especially young or delicate kinds, a watering-can with a good rose should always be used; but it must not be forgotten that this affords a dishonest gardener a greater opportunity

for scamping the work than watering through the plain spout would. The best roses are those made of brass with fine regular holes. The finest roses only should be used for watering seeds in pans or beds. One of the first and most important lessons to teach a garden cooly is that it is the roots, and not the leaves and flowers, that require water, and that a mere wetting of the surface is insufficient. All watering should, if possible, be done late in the afternoon or in the early morning. Always use rain or pond water, if procurable, in preference to well-water. Water mixed with a weak solution of liquid-manure is of great benefit to plants, whether in pots or beds, but it should not be applied when they are suffering from drought, nor until they have their root system well-established after potting.

To test whether a pot-plant is dry at the roots, give the pot a sharp tap; if it gives a sound like that of an empty pot, the plant is in need of water. If a plant has become very dry at the roots, it should be left for a time in a bucket of water to become thoroughly soaked. When the leaves droop, it is generally a sign that the plant needs water. No water should be allowed to remain in the saucer or vases in which flower-pots are standing, for this will cause a stagnant condition of the soil, injure the young rootlets, besides affording a breeding-ground for mosquitoes.

Plants vary in their capacity for drawing moisture from the soil, i.e., some have more rapid transpiration than others. Some have a thin epidermis and take up a large amount of water; while others of a succulent nature, as Cactus, Agaves and Aloes, have a thick cuticle and relatively take up very little water, being therefore able to thrive in dry arid regions. Vigorous-growing plants require more water than slow-growing species; while deciduous plants, when they have shed their leaves, should be watered but sparingly, as owing to their transpiration surface being then reduced to a minimum, excessive moisture at this stage may prove fatal to them. During wet weather there is less evaporation of water from the leaves, therefore plants then take up less water by their roots, while in dry weather the conditions are reversed. Plants give off moisture more rapidly when exposed to wind or sunshine than when growing in the shade, and therefore require more water. When the roots are confined in a small area naturally there is a great demand on the supply of water available, so that plants in this condition require frequent and copious supplies of water.

Syringing.—The operation of syringing is very essential to the health of plants growing under cover, where the natural rain

does not reach them. Syringing creates a moist atmosphere, cleanses the leaves and thus assists in promoting their functions as well as in their presenting a cleaner and finer appearance. In dry weather the syringing of plants, which should only be done with perfectly clear water and through a fine rose, may with advantage be carried out twice or three times a day. During wet and dull weather, however, it should be done sparingly, if at all.

FRENCH OR INTENSIVE GARDENING

It is well known that in France is practised a system of closer or more intensive cultivation of the soil than obtains in England or neighbouring countries. The term is a broad one, but the general principle is the same, viz., that of getting the most out of the soil in the shortest time possible, to procure crops at the most profitable seasons, and to waste absolutely no more space or produce than is avoidable. Thus, in economising space, the paths are generally not more than 9 or 12 inches wide, and the distance of planting or sowing are regulated by measured boards, or by a definite scale. Quick-growing crops are sown or interplanted with those of slower growth, so that the former may be reaped before the latter have attained maturity and without interfering with the growth of either. By means of hot beds and cloches, many articles of vegetable and salad are produced throughout the Winter and Spring, when, being "out of season," command very remunerative prices. The system has in recent years been introduced into England, where, however, owing to the more expensive labour and transport charges, and the comparatively smaller consumption of salads and vegetables than in France, the conditions for success are naturally less than in the latter country.

SECTION 2.

CHAPTER X.

FRUIT CULTIVATION

It is hardly necessary to explain that by the term "fruit" here is meant *dessert fruits*, as distinguished from fruits which are cooked and used as vegetables, as Bread-fruit, Jak-fruit, Cho-cho, Bandak-kai, Gourds, etc. Many of these latter may, however, be eaten either raw as "fruit," or as a "vegetable" when cooked, e.g., Jak-fruit, Granadilla, Tomato, and Papaw. Botanically speaking, any portion of a plant which produces a seed is a fruit. As compared with most European fruits, the great majority of edible tropical fruits have undergone but little improvement by the process of cultivation and selection. Many of them are nevertheless capable of being greatly improved in quality by a system of careful selection and hybridising, and by bud or graft propagation. Following on these lines, the cultivator should aim at producing or selecting fruits which approach a seedless state, as has already been attained in the case of the Banana, Pine-apple, Orange and others.

Fruit-culture for Market.—In recent years fruit-growing for export has considerably advanced in the West Indies, South Africa and Australia, forming an important industry in these countries. The export of tinned pine-apples has developed into a considerable source of revenue in Singapore, Cuba, Hawaii etc., while the inhabitants of the Canary Islands are chiefly dependent on the cultivation of tropical or sub-tropical fruits, which go to supply the London and other European markets. Many of the more purely tropical fruits, however, are as yet practically unknown outside the countries of their production. Hitherto fruit-growing in Ceylon has been carried on in an haphazard manner, either as an auxiliary means of livelihood or for private consumption, and it is asserted that there is not sufficient inducement to make it a business venture. Yet the requirements of the Colony in the way of fruit, either

SELECTED EDIBLE TROPICAL FRUITS.

Key to Block on Opposite Page.

1. *Citrus Decumana, var.* [Pomelo or Grape-fruit]
2. *Durio zibethinus.* [Durian].
3. *Artocarpus integrifolia.* [Jak-fruit].
4. *Artocarpus incisa.* [Bread-fruit].
5. *Citrus nobilis.* [Mandarin Orange].
6. *Monstera deliciosa.* [Mexican Giant Creeper].
7. *Nephelium lappaceum.* [Rambutan].
8. *Persea gratissima.* [Avocado Pear].
9. *Vangueria edulis.* [Voa-vanga].
10. *Pangium edule.* [Kapayang, or Pangi].
11. *Passiflora quadrangularis.* [Granadilla].
12. *Carica candamarcensis.* [Mountain Papaw].
13. *Musa paradisiaca.* [Plantain or Banana].
14. *Carica Papaya.* [Papaw or Tree-melon].
15. *Anona squamosa.* [Custard Apple].
16. *Anona reticulata.* [Bullock's Heart].
17. *Anona muricata.* [Soursop].
18. *Anona Cherimolia.* [Cherimoyer].
19. *Canarium commune.* [Java almond].
20. *Psidium Cattleyanum.* [China Guava].
21. *Citrus medica.* [Citron].
22. *Garcinia Xanthochymus.* [Cochin Goraka].
23. *Mammea americana.* [Mammee Apple]
24. *Eugenia malaccensis.* [Rose Apple].
25. *Macadamia ternifolia.* [Queensland-nut].
26. *Chrysobalanus Icaco.* [Coco Plum]
27. *Feronia elephantum.* [Wood-apple].
28. *Punica granatum.* [Pomegranate].
29. *Mangifera indica, var.* [Mango].
30. *Passiflora edulis.* [Passion-fruit, or Sweet-cup].
31. *Sandoricum indicum.* [Santol].
32. *Diospyros discolor.* [Velvet-apple].
33. *Diospyros Kaki.* [Persimmon].
34. *Photinia Japonica.* [Loquat].
35. *Psidium Guyava.* [Guava].
36. *Sarcocephalus esculentus.* [Negro Peach].
37. *Cynometra cauliflora.* [Nam-nam].
38. *Averrhoa Carambola.* [Kamaranga].
39. *Flacourtia inermis.* [Lovi-lovi].
40. *Achras Sapota.* [Sapodilla Plum, or Naseberry].
41. *Aberia Gardneri.* [Ceylon Gooseberry, or Ketembilla].
42. *Citrus Aurantium.* [Sweet Orange]
43. *Garcinia Mangostana.* [Mangosteen].
44. *Cyphomandra Betacea.* [Tree-tomato]
45. *Ananas sativus, var.* [Pineapple]
46. *Aegle Marmelos.* [Bael-fruit]
47. *Arachis hypogœa.* [Ground-nut, or Monkey-nut]
48. *Citrus Limetta.* [Lime-fruit].
49. *Anacardium occidentale.* [Cashew-nut].
50. *Physalis edulis.* [Cape Gooseberry].
51. *Terminalia Catappa.* [Country Almond].

fresh, preserved, or in jams, are considerable, and it is probable that were a central factory established in Colombo or Kandy for canning, drying, sterilising, or pulping fruits, as well as for making jams and preserves, it would probably not only prove a profitable undertaking, but also afford the requisite incentive to systematic fruit-growing.

It is a remarkable fact that in Ceylon, if not in the tropics generally, fruits are sold by number rather than weight or quantity; therefore while the public are willing to purchase on these terms the grower has no particular object in improving the size and quality of his fruits. In Jamaica, however, the law now prescribes a measure for the sale of Citrus fruit, viz., a box 2 ft. in length, 1 ft. in breadth and 1 ft. in depth. This is known as the Florida standard orange box.

Climate in Relation to Fruit-culture.—Certain fruits are more adaptable to a wider range of climate than others. Thus, Oranges will thrive in Ceylon from sea-level up to about 6,000 feet elevation, while Mangoes, Plantains, and Pine-apples may be grown up to at least 4,000 feet in specially sheltered localities; yet the requirements of others, as the Mangosteen, Durian and Sapodilla, are more or less strictly confined to the hot and moist low-country below 2,000 feet. A dry rather than wet climate is usually the most suited for fruit cultivation, and the most luscious fruits are generally produced in districts with a comparatively limited rainfall, or where the crops are subjected to intermittent irrigation. Dry weather favours the formation of sugar in fruit, whilst a prolonged wet period is against the proper development of flavour and colour, and also of keeping qualities. It is remarkable that fruits which are produced in an equable, hot and moist climate are often green in colour, even when fully ripe.

Exception may be taken to the inclusion of some of the following species as edible fruits, but since the list would not be complete without these it is deemed advisable, in a work of reference, not to omit them; some may, at any rate, prove of interest or value to the plant breeder.

TROPICAL FRUITS SUITABLE FOR LOW OR MEDIUM ELEVATION

WITH A RAINFALL OF 70 INCHES OR MORE.

NATURAL ORDER IN BRACKETS. *S*=SINHALESE; *T*=TAMIL.

Alberia Gardneri. (Bixaceæ). Ceylon Gooseberry; "Ket-embilla," S. and *T.*—A small shrubby tree endemic in Ceylon, bearing large purple, velvety berries, of the size, form, and

consistency of gooseberries; these have a pleasant acid taste, and make excellent jam or a preserve. The fruit is in season during August and September. It is well worth cultivation, being capable of improvement by systematic selection and propagation. It is cultivated as a fruit-tree in Peradeniya Gardens, where plants are raised

CEYLON GOOSEBERRY.—*Alberia Gardneri.*

for distribution. The tree thrives in rich humous soil, and likes good drainage. In propagating from seeds, the latter, being small, should be sown in pots under cover. (*See illustration*).

Achras sapota (Sapotaceæ, Gutta family). Sapodilla-plum; Zapote; Bully-tree; Naseberry; Chiku; "Rata-mi," *S*; "Shimai-eluppai," *T*.—A small symmetrical tree, 25 to 30 ft. high, with leathery dark-green shining leaves, native of Tropical America and the West Indies; introduced to Ceylon about 1802, but as yet

only occasionally cultivated, chiefly in the Kalutara and Galle districts. The round or oblong fruit is not unlike a smooth brown-skinned potato in appearance. Unless perfectly ripe it is unfit for eating, owing to the gum and tannin it contains; but after keeping for a few days it becomes delicious. The skin is extremely thin, and the interior consists of a pale brown juicy and most luscious pulp, in which the large black shining seeds are embedded. FIRMINGER said: "A more luscious, cool and agreeable fruit is not to be met with perhaps in any country in the world." The tree is somewhat commonly cultivated in Lower Bengal, and thrives up to 3,000 ft. elevation in Southern India; but in Ceylon it is seldom productive above 1,500 ft., and succeeds best at the coast. It is a slow grower, and may be propagated by seed, but preferably by grafting; usually bears two crops a year, one during August and September, and the other in February and March. In India the fruit is sometimes erroneously called "mangosteen." See *Chickle Gum*.

Aegle Marmelos (Rutaceæ, Orange family). Bengal-quince; Bael-fruit; "Baeli" *S.*; "Vilvam" *T.*—A small spiny tree, originally a native of India, now commonly grown in the low-country of Ceylon and other tropical countries for its fruit. The latter is globular, with a hard, woody, green shell, and varies in size from that of a cricket ball to a large melon; it encloses a mass of doughy aromatic pulp, intermingled with which is a limpid glutinous substance, which some people relish for its flavour, but more particularly for its medicinal value. This is a well-known specific for dysentery, and is much used in native medicine. The principal season for the fruit is during the months of February to May. The tree is propagated by seed, and thrives in ordinarily good soil.

Anacardium occidentale (Anacardiaceæ, Mango family). Cashew-nut; "Caju-gaha" *S.*; "Mundiri-maram" *T.*—A spreading tree, about 30 to 40 ft. high, with large leathery leaves, considered to be a native of the West Indies, but thoroughly naturalised in Africa, Ceylon, India, etc. Its well-known fruit consists of two distinct parts, viz. (1) the large swollen pear-shaped stalk (*cashew-apple*), 2 to 4 inches long, which is juicy, astringently acid, and used in preserves; (2) the small kidney-shaped, grey or brown *nut* (about 1 inch long) at the extremity. The latter has an edible kernel (seed), which when roasted is of a very agreeable nutty taste, and is much relished for dessert, being considered by some superior to all other nuts; it is in demand in Europe, to which it is exported, for confectionery and flavouring purposes.

The crusted shell of the nut is acrid and poisonous. All parts of the fruit are of various uses in medicine. An intoxicating beverage ("Kaju"), largely consumed by the Natives in parts of Eastern Tropical Africa, is made from the fleshy receptacle. The tree yields a gum which is obnoxious to insects and is recommended for book-binding. The juice obtained from incisions in the bark forms an indelible ink. The tree thrives best in the low-country up to 1,500 ft. Adapted for moderately dry districts, especially near the sea. Propagated from seeds or by layering.

Ananas sativus (Bromeliaceæ). Pine-apple; "Anasi" *S.*—A perennial stemless plant, with long narrow fibrous and usually

PLANTATION OF "KEW" PINE-APPLES.

spiny leaves, native of Tropical America, introduced into all warm countries, and extensively cultivated in South America, West Indies, Cuba, Hawaiian Islands, Queensland, etc. The fruit is borne by a rigid stout stalk issuing from the centre of the plant; the latter dies after maturing the fruit, being reproduced by suckers thrown out from the base. In a state of nature the pine-apple is generally an *epiphyte* or "air-feeder," i.e., living in the forks of trees or on rocks; but in cultivation partial shade and a sheltered situation are necessary in order to produce the best crops. In Florida, where pines are cultivated extensively as an industry, the plants are grown chiefly under the shade of lightly constructed sheds. Pine-apples

thrive in Ceylon from sea-level to about 2,000 ft., or higher in sheltered situations. The plants are naturally suited to a rather dry climate, but flourish also in moist and hot districts, provided the land is well-drained. They thrive best in rich humous or loamy soil, specially if it contains a proportion of lime. Fallow or jungle soil, under the shade of trees, yield the largest and most luscious fruits. After the first crop has been obtained, the plants should be taken up, the ground deeply dug and enriched with well rotted manure. The rows should be planted in the inter-spaces of the previous crop, if any. A change of site should be given after every second or third crop, as otherwise the quality and size of the fruit will be adversely affected.

"HEN AND CHICKEN" PINE-APPLE.

Manuring is essential; animal manure is the best and should be applied in a well-decomposed state. Of mineral manures, a mixture of basic slag and nitrate of soda, in the proportion of 5 cwt. and 1 cwt. of each respectively for an acre, is recommended by experienced growers. A potash manure is also very beneficial. The ground should be well-tilled and kept free of weeds. When planting, the strongest suckers should be used, as these produce the earliest fruits. Trim off the lower leaves, and plant in rows, about 4 feet apart each way, say 2,800 plants to the acre. The fruit should commence to ripen about 15 months from the time of planting the suckers, the weaker suckers taking longer to bear fruit. A return of about 5,000 fruits per acre is considered a good yield. When suckers are scarce, the "crowns" of the fruit may be planted in a bed of leaf-mould and sand, for

planting out when large enough. Plants may also be propagated from the leaves, these being laid in a bed of light sandy soil and kept moist and shaded. (*See illustrations*).

VARIETIES.—A large number of varieties occur in cultivation, and different names are given in different countries to the same varieties. One of the most distinct and best variety is the "*Smooth Cayenne*," known in Ceylon as the "*Kew Pine*." This bears large, luscious and juicy fruits, often weighing from 10 to 15 lb.; sometimes 20 lb. or more. This variety has the additional merit of having spineless leaves. It is said to be the chief variety cultivated in Hawaii, Florida, and Azores, and commands the highest price in the London market. In the West Indies the "*Red Spanish*" is perhaps the most popular kind, the "*Ripley Queen*" or "*Black Antigua*" being also highly spoken of. "*Mauritius*" ("*Ripley Queen*") is the variety most commonly grown for market in Ceylon; it is of a hardy nature, thriving in comparatively poor soil. "Gal-anassi" is a variety naturalised in Ceylon, distinguished by small yellow, rather insipid fruits. The following are amongst the best varieties cultivated in the West Indies:—"*Abbaka*," "*Black Antigua*," "*Sugar-loaf*," *Monsterat*," "*Egyptian Queen*," "*Pernambuco*," "*Porto Rico*," "*Bracomorensis*."

Anona muricata (Anonaceæ). Sour-sop; "Katu-anodo" *S.*; "Seetha" *T.*—A small, quick-growing shrubby tree, 15 to 20 ft. high, with fragrant laurel-like leaves, native of the West Indies and commonly grown in the Eastern Tropics for its fruit as well as for ornament. The large green fruit, usually weighing from 4 to 6 lb. (sometimes 10 lb. or more), varies in form from kidney-shaped to oval or ovate, and is covered with soft green prickles. The white, rather wooly pulp, amongst which the large black seeds are scattered, is juicy and sweet, suggesting the flavour of Pine-apple, and is sometimes used for flavouring ices and in the preparation of a pleasant cooling drink. The fruit, though of an agreeable flavour, is not generally popular. There is, however, much difference in the produce of different trees, and the fruit of some has been described as "lusciously sweet and of a delightful acidity." Propagated from seed or cuttings. Thrives up to 2,000 ft. (*See illustration*).

A.—reticulata. "Bullock's Heart; "Anoda" *S.*; "Ramsita" *T.*—A small bushy tree of Tropical America and the West Indies, commonly met with in native gardens in the low-country of Ceylon. The fruit is usually heart-shaped, sometimes round, 3 to 4 inches across, and varying in colour from brownish-red to yellow. It contains several large dark-brown seeds interspersed among the sweet custard-like granular pulp. Some Natives in the low-country are, I am informed, prejudiced against this fruit, owing to a supposition that it causes leprosy. Propagated from seed, which may be sown in nursery beds. Will thrive up to 3,000 ft. or higher. (*See illustration*)

A.—squamosa. Custard-apple; Sugar-apple; Sweet-sop.—A small tree, considered to be a native of Asia and Tropical America. It is commonly cultivated throughout the tropics for its fruit, which is of the size of a fairly large apple, and has a peculiar rind which appears to be formed of scales; when ripe, these latter break away separately, exposing and partly adhering to the white

SOUR-SOP.—*Anona muricata.*

granular, sweet custard-like pulp. The fruit should be wrapped in muslin bags before they attain maturity, so as to prevent their being eaten by squirrels and birds. Custard-apples are chiefly in season during the drier months, when they are commonly sold in the markets and native bazaars. The tree is propagated from seed, and thrives in ordinary, well-drained soil up to about 2,500 ft. In

India the fruit is said to be grown to perfection in the neighbourhood of Cawnpore, "thriving in the most barren and sterile places."

Artocarpus incisa. (Urticaceæ, Fig family). Bread-fruit; "Rata-del," *S.* "Erapillakai," *T.*—One of the most handsome of tropical trees, native of the Pacific Islands, Java, etc.; introduced to Ceylon before 1796. It is a quick grower, attaining a height of

BULLOCK'S HEART.—*Anona reticulata.*

40 to 60 ft. and bearing very large, shining, deeply-cut leaves. The fruit is roundish or oval, 4 to 6 inches long by 3 to 5 inches in diameter, pea-green in colour, and produced in twos or threes at the ends of the branches. It seldom contains seed *(except in the case of inferior varieties), the interior consisting of a solid mass of white fleshy pulp, which when sliced and roasted is not unlike the

* Some varieties contain numerous large fleshy seeds, like those of Jak, these being eaten, while the comparatively scanty pulp is not.

crumb of a new loaf. As a vegetable for curries, it is much esteemed by all who enjoy these. It is also roasted, ground into flour, and prepared and used in various other ways. Bread-fruit is said to form the principal article of diet of the Natives of the South

BREAD-FRUIT.—*Artocarpus incisa.*

Sea Islands. FIRMINGER, after partaking of the fruit in Ceylon when sliced and fried, considered it to be "hardly distinguishable from an excellent batter pudding." The tree thrives up to 1,500 ft. in the moist hot districts of Ceylon, and is especially adapted to

the sea-coast. Propagated by suckers from the roots, by gootee or layering. (*See illustration*).

A.—integrifolia. Jak-fruit; "Kos" *S.* "Pilla-kai" *T.*—A very large tree, native of South India and Malaya, introduced and cultivated in Ceylon, where it has become semi-naturalised. The enormous fruits, one of which may weigh up to 100 lb. or more, are borne on the trunk and older branches, sometimes at the base of the

JAK-FRUIT.—*Artocarpus integrifolia.*

trunk or even under-ground. It is usually oblong and irregular in shape (sometimes almost round), being always green, with the rind consisting of somewhat hexagonal knobs. This fruit forms a very important article of food with the Natives of the Eastern Tropics, while some Europeans also relish it, especially the seeds when cooked and served in curries. When ripe, the fruit has an overpowering odour, and the stronger the latter is, the better apparently the quality of the fruit. With the exception of the rind and core, the whole of the fruit is eaten, the white or cream-coloured

soft, flakey pulp being eaten either raw, boiled, or fried, and used as a vegetable for curries, etc. The large albuminous, date-like seeds are roasted and esteemed in curries. The timber is excellent for cabinet work, building, etc., and is much used in Ceylon;

WILD BREAD-FRUIT.—*Artocarpus nobilis.*

lemon-yellow at first, it turns with age to a very dark tint like mahogany, to which it is but little inferior. The tree is propagated by seed and is suited to moist or semi-dry districts, up to 2,000 ft. (*See illustration*).

VARIETIES.—Jak-fruit occurs in several varieties, the two most distinct in Ceylon being :—(1) "Waraka," distinguished by a firm fruit, which the Natives recognise by the sound when flicked with the fingers ; (2) "Vela," characterised by its softer rind, through which the finger may be thrust when approaching ripeness, the pulp being less sweet than that of the former variety. Of these there are several sub-varieties as "Kuru-waraka" (with small and almost round fruit), and "Peni-waraka" (=honey-jak), which has a sweetish pulp. A variety called "Johore Jak," with hairy leaves and a small oblong fruit with a most overpowering odour, is greatly esteemed by those who eat the fruit.

A.—nobilis. Wild Bread-fruit ; "Wal-del" *S.* ; "Asini-pillakai *T.*—A noble tree, usually 40 to 50 ft. high (but sometimes attaining an enormous size), with large leathery, crimpled or wavy, undivided leaves, peculiar to the moist low-country of Ceylon. The fruit is cone-like, 5 to 8 inches in length by 1½ to 2 inches in diameter ; it is similar in texture, though inferior, to the Bread-fruit proper, and is eaten by the poorer classes, being cooked and used as a vegetable with curries. It contains several round white seeds, of the form of large peas, which are roasted and eaten. The tree thrives in a wild state up to 2,000 ft. in the moist low-country of Ceylon, where it is endemic. Propagated by seed.

Averrhoa Bilimbi (Geraniaceæ). Cucumber-Tree ; "Blimbing ;" "Biling" *S.* ; "Bilimbi-kai" *T.*—A small fine-foliaged tree, native of the Moluccas, and commonly cultivated in the Eastern Tropics for its fruit. The latter is about 3 inches long, resembling a small green cucumber, and produced in clusters on the trunk and oldest branches ; it is esteemed in pickles and preserves, and is sometimes used for making jam and cooling drinks. As an ingredient in curries, the fruit is also much relished. The tree thrives up to medium elevations, and is propagated from seeds or by layering. The seed, being small, should be sown in pots under cover.

A.—Carambola. Karambola ; "Kamaranga" *S.* ; "Tamarta" *T.*—A small tree, similar to the preceding species, but more ornamental in habit. It is a native of the Moluccas, and has long been in cultivation in the East. The curious oval-shaped, winged fruit, borne in great profusion, gives the tree a striking effect. When ripe the fruit is semi-transparent, of a fine rich amber colour, very juicy, and of a sweet acid taste. Its principal culinary use is for making jelly, for which it is esteemed. The juice removes stains from linen, and is also commonly used for burnishing brass. The degree of acidity of the fruit varies in different varieties. I have tasted some at Shows which were agreeably sweet and well worth

growing for the table. The best varieties should be propagated by gootee or budding, though the tree is usually propagated from seed; the latter being small, should be sown in pots under cover.

BRAZIL-NUT.—*Bertholletia excelsa.*

Bertholletia excelsa. (Myrtaceæ). Brazil-nut, or Para-nut.—A tall handsome tree, with oblong wavy leaves, which are 14 to 16 inches long and about 3 inches broad, native of Guiana, Venezuela and Brazil. In its native home, specially on the banks of the Amazon and Orinoco, the tree attains a height of over 100 ft.

The tree has been introduced at Peradeniya in 1880, and, notwithstanding the indifferent ground chosen for it when first planted out, appears to find here a congenial home. It is now about 60 ft. high, and produces at the top each year, in the dry season, large erect racemes of white flowers, followed a few months later by a number of large brown round fruits, which hang on the tree for some months after ripening. RIDLEY records similar success with the tree at Singapore, where it was introduced in 1881. Each fruit is from 4 to 6 inches in diameter, with a hard, brown woody shell, which has to be sawn or broken with an axe in order to obtain the nuts (seeds). In the interior, closely packed, are from 10 to 12 large angular seeds with a brown horny testa; these are the "Brazil-nuts" of commerce, which form an important article of export from their native country, being largely used for dessert in Europe, America, etc. The tree may be propagated by seed or gootee (layering), and thrives best on a rich alluvial soil, in a hot and moist climate (*See illustration*).

Blighia sapida,=Cupania edulis (Sapindaceæ). "Akee."—A fairly large spreading tree, native of West Tropical Africa, introduced and cultivated to some extent in the West Indies for the sake of its edible fruit. The latter is of the size and form of a small lemon or pear, about 3 inches in length, and bright red when ripe. The seeds, of which two or three are in a fruit, are jet-black and of the size of small marbles. The edible portion is the firm, cream-coloured fat-like substance (*aril*), developed in a succulent socket around the base of the seed. This is generally cooked, but may also be eaten raw, and is considered delicious when par-boiled with salt, and stewed or fried with butter. The fruit when ripe splits open, and must then be picked, as on long exposure to the air the aril becomes discoloured and unfit for food. Between the two lobes of aril there is a pink integument; this must be removed when preparing the aril for eating, as it is considered highly poisonous. The tree is suited to the moist or semi-dry low-country up to about 2,000 ft. There is a tree in the garden at "Temple Trees," Colombo, which bears fruit freely twice a year, chiefly in April and September. The tree may also be found in some Indian Gardens, but so far as I know the fruit is never eaten in Ceylon or India. Propagated from seed or by gootee, or sometimes by suckers.

Buchanania latifolia (Anacardiaceæ). "Cheronjee."—A moderate-sized tree, attaining about 30 ft. in height, and bearing

simple, leathery leaves, native of the mountainous parts of Coromandel, Malabar, Mysore, etc. The kernels of the fruit are of the size of small pears, and are said to be passed as a general substitute for almonds, being considered superior and more agreeable to the taste than either the Cashew-nut, Country-almond, or Ground-nuts. They are sometimes sold in the bazaars in India at 4 to 6 annas per lb. The tree is not known in Ceylon, but might be found suited to medium elevations in the Uva Province. Propagated by seed.

Canarium commune (Combretaceæ). Java Almond; Pili-nuts; "Ratakekuna" *S.*—A large handsome Malayan tree, characterised by a remarkable buttressed trunk and latterly compressed aerial basal roots; the latter develop enormous erect flanges of uniform thickness, so that solid circular pieces may occasionally be cut out from them to form ready-made cart wheels. The tree is much cultivated for shade or ornament in Java. It bears in great abundance large pendant clusters of dark-purple fruits, which are of the size of small plums; these are produced all the year round, but chiefly in June. The kernel of the fruit is edible, being similar in flavour to Sweet Almonds; it yields by expression an oil used for burning in lamps and for cooking purposes. A considerable quantity of the "nuts," collected from wild trees, is said to be exported from the Philippines. A desirable tree for planting in avenues, etc. It thrives in hot and moist districts up to about 1,500 ft. elevation, and prefers deep, well-drained soil. Propagated by seed, which may be sown in nursery beds and kept moist and shaded until germinated.

Carica Papaya (Passifloraceæ). Papaw; Tree-melon; "Pepol" *S.*; "Pappali" *T.*—A fast growing, small, herbaceous, branchless and diœcious tree, attaining a height of about 15 to 20 ft., indigenous to Central America and the West Indies. It bears a crown of very large palmate leaves, at the base of which the large green fruits are produced. The latter vary from round to oval or oblong in shape, but are usually 8 to 14 inches long by 4 to 6 inches in diameter, not unlike green melons or gourds, each weighing from 5 to 8 lb. or more. The fruit has a central cavity, to the walls of which the olive-coloured seeds are attached, usually in great abundance, but are sometimes entirely absent. The succulent flesh, which varies in colour from a slight pinkish to an orange tint, is very refreshing and agreeable to the taste, especially on first acquaintance with it. It is commonly used for dessert, and is

considered an aid to digestion. Some people prefer to eat it with a little sugar and fresh lemon or lime juice. It may also be made into jam or sauce, and in the unripe state may be pickled, or

PAPAW, OR PAPAYA.—*Carica Papaya.*

boiled and used as a vegetable. The seeds have a flavour like that of water-cress, and are relished by some as a substitute for it. The milky juice (*papaine*), obtained from incisions made in the unripe fruit (by a bone or ivory knife), curdles milk, like rennet, and is

sometimes used as a substitute for pepsin in medicine. It is collected in porcelain or glass dishes, dried in the form of small balls or powder, and exported (chiefly from Jamaica) to Europe, America, etc. An average of $\frac{1}{4}$ lb. papaine may be obtained per tree. Fair quality papaine may fetch from 5*s.* to 8*s.* a lb., but the demand is limited and irregular.* The property of the leaves in rendering meat tender is well known, and is commonly made use of by cooks

PLANTATION OF PAPAW, OR PAPAYA. *(Carica Papaya.)*

in Ceylon and elsewhere, who either wrap the leaves round the fresh meat, or place a piece of the green fruit in the water in which the meat is boiled. The tree bears fruit continuously from the time it is about ten to twelve months old, but deteriorates at the age of five to six years, after which its fruitful life is practically over. The flowers being usually *unisexual*, the tree is dependent on

*The export of papaine from Ceylon in 1911 was 6,610 lb. valued at £ 2,281, and in 1912, 12,920 lb. valued at £ 3,378. About $\frac{2}{3}$ of this was in each case destined for the United States, Germany being the next largest consumer.

cross-fertilisation for its reproduction by seed. Therefore the varieties become much mixed, the fruit varying from globose to long and narrow, with many, few, or no seeds. Occasionally, however, *bisexual* flowers are produced by either male or female trees which are normally *unisexual*; thus "male" trees sometimes bear fruit, which only differs from that of "female" trees by being smaller and perhaps less palatable. Propagated from seed, which germinate readily. These are of the size of small peas; about 250 when fresh go to an ounce, or 1,260 when dry. Sow thinly in nursery beds. Suited to the moist low-country, and thrives best in rich well-drained soil. (See *Mountain Papaw*).

Carissa Carandas (Apocynaceæ). "Maha-karamba" *S.*; "Perunkila" *T.*—A small tree or large shrub, with sharp, rigid, forked thorns and oval leaves, native of the dry region of Ceylon, also of India and Malaya. It blossoms chiefly in February to March, and ripens its fruits in August and September. The fruit when ripe much resembles a damson, both in size and colour; but in the interior are a number of small seeds. In India it is made into a pickle just before it is ripe, and is also used in tarts and puddings, being considered to resemble gooseberries in flavour. For these purposes it is said to be "superior to any other Indian fruit." When ripe it makes a very good jelly. The plant is commonly employed for barrier hedges, for which purpose it is well suited. Propagated from seed. Suited to dry districts at low elevations.

Caryocar nuciferum (Ternstroemiaceæ). Butter-nut; Souari-nut.—A handsome lofty tree, attaining a height of over 100 ft., with large lanceolate, trifoliate leaves, native of Brazil and British Guiana. It bears a large roundish, woody fruit, about the size of a child's head, containing when ripe four large kidney-shaped seeds, which have a very hard woody, warty, and reddish shell. The latter is so hard that it needs an axe to break it open. The kernels have a pleasant nutty taste, and are esteemed in England for confectionery and fruitarian dishes. They yield by pressure a valuable oil. Souari-nuts are imported into England, and may usually be seen in Covent Garden, or sometimes retailed in London at about 3*d*. or 4*d*. each. The tree flourishes in the moist low-country of Ceylon, and prefers rich deep or alluvial soil. The two trees in the Peradeniya collection, introduced in 1891, grow luxuriantly and have flowered freely since 1910, but not yet fruited. Propagated by seed (*See illustration*).

Chrysobalanus Icaco (Rosaceæ). Icaco; Coco-plum; Spanish-nectarine.—A small spreading shrubby tree, native of Tropical America. It bears fruit of the size and shape of a plum, varying from round to egg-shape, with a purplish tender rind; the scanty white pulp, adhering to the kernel, is of a somewhat agreeable acid taste. The fruit is said to be largely made into conserves

BUTTERNUT TREE.—*Caryocar nuciferum.*

in Cuba, being in this form an article of export; but in Ceylon it is a very poor fruit, hardly worth growing. The tree succeeds in the moist low-country up to 2,000 ft., and is propagated from seeds.

Chrysophyllum Cainito (Sapotaceæ). Star-apple; "Ratalawulu" *S.*; "Seemaipala-Pallam" *T.*—A fairly large and

handsome West Indian tree, with striking dark green leaves, which are copper-coloured underneath. The purplish, smooth, round fruit is four-seeded, the seeds being brown and ½ inch long. In an unripe state the fruit contains a sticky white latex, but when fully matured the white, transparent, jelly-like substance surrounding the seed is sweet and agreeable. The fruit when cut across presents a stellate form, the cells with their white edible contents radiating from the central axis; hence the name "star-apple." The tree is well worth cultivating for ornament or shade for roadsides, etc. It thrives at Peradeniya, where it was first introduced in 1802. Propagated by seed, and thrives best in deep, rich and well-drained soil.

C.—monopyrenum. Date-plum; "Kos-eta-lawulu" *S.*; "Seemaipala-pallam" *T.*—An ornamental West Indian tree, of more slender and upright habit than the preceding species, but resembling it in the foliage; introduced at Peradeniya in 1814. As the vernacular names signify, the fruit is similar in size and form to a date-fruit or a Jak seed, and suggests a damson in form and colour; it has a thin shining, purplish-black outer skin, and contains but one seed; the milky reddish pulp is edible, but rather insipid. The principal fruiting season for both this and the preceding species is from February to April. Propagation by seed.

Citrullus vulgaris (Cucurbitaceæ). Water Melon. "Komadu" or "Peni-komadu" *S.*—A smooth, oval-shaped fruit, usually about 8 to 10 inches long, produced by a quick-growing creeping gourd, commonly cultivated in the dry region of Ceylon and in the tropics generally. The fruit is of a dark-green colour, with a reddish juicy flesh, which is cool and refreshing in the hot season, though rather insipid. In India it is described as in some cases growing to an enormous size, "sometimes 3 to 4 ft. in length and from 18 inches to 2 ft. in diameter," but the smaller-sized varieties are the best. It is occasionally spherical in shape. The plants will thrive on ordinary soil, provided sufficient moisture is afforded at the root, and are best suited to dry districts. In India they are commonly grown on the banks of rivers, where the Natives often bury the fruit with sand, under which it grows and ripens slowly. Easily propagated by seed.

Citrus aurantium (Rutaceæ). Sweet orange; "Peni-dhodan" *S.*; "Naran-kai" *T.*—A small tree or shrub, 8 to 12 ft. high, supposed to be a native originally of Northern India. The Orange has long been cultivated in all warm climates, and is especially adapted

to regions where the trees are subject to wintering, or at least a short period of rest. It luxuriates in the torrid zone, and is more or less naturalised in the moist low-country of Ceylon; but the fruits here produced are often coarse and thick-skinned, being usually green in colour when ripe. These defects, however, may be largely due to the want of a proper system of cultivation and selection, as well as to the effects of the tropical climate. At the higher elevations in Ceylon, imported grafted plants flourish for a few years and produce attractive yellow fruits of good quality, but the excessive rains and strong winds often prove detrimental to both the fruit crop and the health of the tree.

The nearest approach to the proper conditions for successful orange culture in Ceylon would appear to be found in the drier parts of the Uva Province, between 1,000 and 3,000 ft. elevation. A gentle slope with free natural drainage, a light rich soil with a marly or limestone sub-soil, a rather dry climate and shelter from strong winds,—these are the conditions which are especially suited to the requirements of the tree. A "resting period" is imitated annually in India, usually with good results, by stopping the water supply, and opening up the soil around the tree, the fibrous roots nearest the stem being cut off in the process; this, naturally, has the effect of making the trees drop the greater part of their leaves. When the roots have been thus exposed for a month or two, the soil is again filled in, and manure added. The sea-breeze is considered to be injurious to Orange culture, yet the Cotta oranges, grown on the sea-board, are noted in Ceylon for their excellence. In the dry region of Ceylon, oranges would probably do well under irrigation, as their cultivation is successfully carried on under similar conditions in parts of India, etc. The Orange tree has no serious pest in Ceylon (See *Insect and Fungus Pests*).

Propagation of the Orange is best by budding or grafting (especially the former) upon the hardy and vigorous growing kinds of Citrus, as the Sour-orange and the Pumelo. Only budded, grafted, or layered trees can be relied upon for producing fruits of a uniform type and quality. The flowers being naturally subject to cross-fertilisation, plants raised from seed are obviously liable to produce fruits of a variable character. Seedling trees are, however, usually the healthiest and longest-lived. In raising seedlings, care should be taken to choose the best fruits, selecting from these only full and plump pips or seeds. Sow the latter in well-prepared

soil, covering them with about $\frac{1}{2}$ inch of finely sifted earth. The seeds will germinate in about fourteen days; when the seedlings are 2 or 3 inches high, transplant them into small plant-baskets or bamboo pots. These should be ready for budding or grafting in the course of 8 or 10 months, and the budded or grafted plants should be fit for planting out when about 2 years old.

Planting and Yield. The distance for planting apart should not be less than 15 by 15 ft., allowing, say, 193 trees to the acre. The trees should commence to bear when about four or five years old, and are considered to be in their prime at the age of fifteen years. When in full bearing each tree should yield from 300 to 700 fruits a year.

Manuring and Mulching. Although any well-decomposed organic manure may be applied with advantage, the chief requirements of the Orange tree are considered to be lime and potash. A successful grower in Australia applies 5 lb. bone-dust and phosphate of lime to each tree once a year, while in Florida burnt-shell lime is applied at the rate of $\frac{1}{2}$ ton to the acre. The ground around the tree should be frequently stirred, and never allowed to harden. A light mulch of litter or leaves is of great benefit in hot dry weather.

Pruning Oranges. Good orange trees require little or no pruning, except as regards the removal of superfluous, dead, or broken branches. The plants should be topped at a height of about $2\frac{1}{2}$ ft., so as to induce a spreading and evenly balanced form. The fruits, it should be remembered, are borne on one year old wood. Excessive woodiness may sometimes have to be checked by cutting the tap-root below 15 inches from the surface.

Bi-Products of the Orange.—Various by-products are obtained from oranges, as *candied peel* (from the rind); *citric, lactic*, and *acetic* acid (from the fruit-juice); *essential oil* (from the peel); the perfume *bergamot* (from the flowers as well as rind); also *orange wine*, etc., from the pulp. Marmalade, the making of which is a large important industry, is made chiefly from the sour varieties, especially the "Seville orange."

VARIETIES. The following are well-known:—

Jaffa. A large oval fruit of first rate quality; pulp rich and juicy, seeds few or none.

Jamma-naran. See *Mandarin.*

Maltese Blood-orange. Fruit medium size; flesh stained with deep crimson seeds few; tree spineless.

Mandarin; "Jamma-naran" *S.* Loose and thin-skinned, large fruit of deep colour, usually compressed at ends.

Mediterranean Sweet. Thornless tree; fruit medium to large, seeds few.

Nagpur Suntra. An Indian variety, famous for its sweetness.

Navel Orange. Fruit large, with a navel-like mark, very juicy and melting pulp; almost seedless; tree slightly thorny, bears fruit early.

Satsuma. Produces fruits in large bunches, "upward of 50 fruits in each bunch," in Florida.

Seville Orange. A bitter fruit, bright orange colour; the tree thrives and bears freely at Hakgala Gardens, in Ceylon. The finest marmalade is made from this orange.

St. Michael. Large, thin-skinned fruit, of fine flavour.

Tangerine. A variety of *Citrus nobilis*; fruit medium-sized, fine flavoured.

C.—Decumana. Shaddock; Pumelo; "Forbidden Fruit;" "Jambola" *S.*; "Jamblica," or "Bambalinas" *T.*—A small tree, 25 to 30 ft. high, native of Tropical Asia, and commonly cultivated throughout the tropics for its large round or oval fruits. Numerous varieties occur in different countries, varying in the shape and size of the fruit, as well as in the colour and flavour of the pulp; in some varieties the latter is green and acid, in others it is reddish or crimson, juicy and sweet. Some varieties have few or no seed. The fruit is valued for making jams, the best sorts being sometimes used for dessert (*see below*). In Ceylon, the Pumelo grows luxuriantly in the moist low-country, producing large globular fruits which measure from 6 to 9 inches in diameter; it thrives up to about 2,000 ft. elevation, either in moist or semi-dry districts, and is easily propagated by seed. Seedlings of Pumelo are recommended for stocks upon which to graft Oranges.

C.—Decumana, var. "Grape-fruit," so-called because the fruits grow in a cluster like a bunch of grapes. These resemble large oranges, being usually globular in form, but sometimes pear-shaped, with a smooth skin of medium thickness. The pulp is pale yellow or greenish white, sometimes pink or crimson, and is distinguished from that of the orange by being sweeter and composed of larger and distinct "sacks;" it is very juicy, but somewhat bitter in flavour. In the United States, Cuba, Jamaica, etc., the Grape-fruit is very popular, being usually eaten in the early morning or as a dessert. It is imported into England, where it is usually esteemed by those who know it, and finds a ready sale at Covent Garden Market at 4*d.* to 8*d.* each. According to the *British Medical Journal*, it has a "wholesome, clean, slightly bitter taste, blending with the acidity of the orange, and has the physiological action of stimulating the appetite and promoting salivary

and gastric digestion." This fruit has not yet become well-known in the East, though it is sometimes met with in gardens. A seedless variety has recently been discovered which promises to be valuable. Propagated by grafting, budding, or from seed. There are several varieties.

Citrus acida. Lime; "Dehi" *S.* "Dhaisi-kai" *T.*—A small spiny tree, cultivated in all tropical countries for its acid juicy fruit. The latter varies in size, degree of acidity, and juiciness, also in shape from almost round to egg-shape. The lime-fruit is used by all races for flavouring and other culinary purposes; it is largely employed for the manufacture of cooling drinks, especially lime-juice cordial, whilst it is also of much importance in native medicine. Applied externally, it is valued as a cure for snake-bites. Limes are grown as a commercial product in some West Indian Islands, and the export of concentrated lime-juice and citrate of lime (in casks) forms the chief industry of Dominica.* In Ceylon, limes are in season practically all the year round, and are at all times sold in the boutiques and markets. The tree thrives up to 2,000 ft. elevation, preferring a light marly soil with good drainage. It is propagated by seed (pips), or preferably by budding or grafting on stocks of a vigorous growing kind; plants thus raised should come into bearing at three years old.

VARIETIES.—Among the principal varieties recognised in India are :—

"*Patee*" (a small round fruit, much esteemed). "Kaghuzee" (of the size of a hen's egg, in most general cultivation), "Gora" (a small oval fruit much cultivated), "Kamuralee" (a large handsome fruit, of pale lemon colour, about the size of a small coconut), "Rungpore" (a round smooth-skinned fruit), and "Taba" (a large globose, spongy fruit). The "Kaffir Lime" in Ceylon is almost the size of a lemon, with a warty, coarse skin.

Spineless Lime. A sport of the ordinary Lime, said to have originated in Dominica in 1891, the stems and branches being without the usual formidable spines.

Seedless Lime. In recent years several varieties of limes have been raised whose fruits are almost, if not quite, free from seed. The "Persian Seedless" or "Tahiti Lime" is reported as being the chief variety in Cuba; this is said to be a prolific bearer, the fruit containing a high percentage of citric acid.

C.—Limetta. Sweet-lime.—This is a distinct species or variety, the fruit of which is of the form of a moderate-sized orange, with smooth pale-green rind. It has a sweetish, instead of an acid, taste and is considered very refreshing and agreeable. The tree is used largely in parts of India for budding the Orange upon.

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* The trees are planted at average distances of about 12 by 15 ft., and a yield of about 120 barrels fruit per acre is considered a good average.

C.—Limonum. Lemon (See under *Sub-tropical fruits*).

C.—medica. (See under *Sub-tropical fruits*).

Clausena Wampi,=Cookia punctata (Rutaceae). Wampee "Rata-karapincha" *S.*—A small ornamental and aromatic tree, native of China. Its pale yellow berries have a strong aromatic acid taste and are sometimes made into preserves, being also used, as well as the fragrant leaves, for flavouring meat curries, etc.; but they cannot be considered a fruit for dessert. The tree is suited to humid districts at medium elevations, and is propagated by seeds.

Cucumis Melo (Cucurbitaceæ). Musk Melon; "Pitti-kekiri," *S.*—A round or oval fruit, about 4 to 6 inches in diameter, or 7 to 8 in. long by 3 in. in diameter, produced by a creeping annual gourd with large angular leaves. In its natural state the fruit has a strong musk-deer odour, the interior being of a somewhat flowery consistency. The best varieties, as grown in hot-houses in temperate countries, are very highly prized on account of their luscious flavour. The plant is suited to a hot dry atmosphere and rich porous soil. It requires moisture at the root, but the vines are susceptible to a damp atmosphere, and in cultivation the precaution has usually to be taken of forming a collar of earth round the base of the stem, so as to prevent any water lodging there. Musk Melon is never seen grown in the moist low-country of Ceylon, and but seldom in the dry region. FIRMINGER referred to a fine variety in India, called the "Surdah," the fruit of which is "sometimes brought from Cabul to Punjab for the wealthy Natives, who are said to pay as high as Rs. 6/- each for them." The seeds of this variety are distinguished by their very large size. There are many varieties in cultivation, these being divided into "netted" and "smooth-skinned" classes. The flesh in either group may be red, green or white. Propagated by seed, like other gourds.

Cynometra cauliflora (Leguminosæ). Nam-nam.—A shrubby much-branched tree with small binate leaves, native of India and Malaya. The fruit is a one-seeded, much wrinkled, thick fleshy pod, rather semi-circular in shape, and produced in large numbers on the trunk near the ground (sometimes on the lowermost portions of the branches), chiefly in May and June. The succulent green, or greenish yellow, shell is about ½ an inch thick, and is of a pleasant, sweet sub-acid taste, not unlike an apple. Whilst, however, the fruit of some trees is very palatable, that of others may be sour and unpleasant, much depending on the variety and degree of cultivation afforded. The fruit is best for stewing, but is also used for pickling, and the large flat seed yields a medicinal oil. The tree

thrives in the moist low-country of Ceylon up to 2,000 ft., and prefers deep rich soil. Though indigenous to parts of India, it does not seem to be commonly cultivated there, for neither Firminger nor Cameron mentions it. Easily propagated by seed, but the best varieties should be increased by gootee or grafting.

Davidsonia pruriens (Saxifrageæ).—A medium-sized tree, with handsome serrate leaves, native of Queensland. The fruits are of the size of plums, bright pink when ripe, with a reddish flesh. In its native country the fruit is made into jam and preserves. The tree has been introduced to Peradeniya, where, however, it has not yet flowered or produced fruit (1913).

Dialium ovoideum (Leguminosæ). Velvet Tamarind; "Gal-siyambala" *S.* "Kallupullium" *T.* "Kanji" (Malay).—A tall tree with pinnate leaves, indigenous to the semi-dry region of Ceylon. From near the ends of the branches the dark brown velvety fruits are produced in clusters, each fruit being about the size of a small filbert and slightly compressed. The thin brittle shell encloses a seed surrounded by farinaceous pulp, which has an agreeable acid taste and is considered a delicacy by the Natives, who use it in the preparation of a fine chutney. When in season (chiefly October to December) the fruits are collected from the forests, and sold in the markets and bazaars in considerable quantities. The tree affords a handsome dark red timber; thrives at Peradeniya. Propagated by seeds.

D.—Guineense. West African Velvet-tamarind.—A tree similar to the preceding species, but easily distinguished by its larger leaves. The genus is characterised by the flowers having only two stamens, most leguminous plants having ten.

Dillenia indica (Dilleniaceæ). "Hondapara" *S.*—A medium-sized tree with large leaves, native of Ceylon and tropical Asia generally. It produces a profusion of large round green fruits, each about 3 inches in diameter, being juicy and very acid. The fruit is formed by the much enlarged, closely imbricate fleshy sepals; it is used for making jelly and a cooling drink, also sometimes as a vegetable in curries. The tree is often cultivated both for ornament and for its fruit. Propagated by seed, which, being small, should be sown in a pot under cover.

Diospyros discolor (Ebenaceæ). Velvet Apple.—A small slow-growing tree of the Ebony and Persimmon family, native of S. India and the Philippines. The beautiful bright pink, velvety-looking fruit is of the size of an apple and is considered edible, but

the author does not think it worth classifying with edible fruits, unless other varieties are superior to that grown in Peradeniya Gardens.

Durio zibethinus (Malvaceæ). Durian; Civet-cat Fruit.—A very large, handsome pyramid-shaped tree, native of the Malay Archipelago, and commonly cultivated in the Straits, Burma, Java, etc. for the sake of its celebrated fruit. The latter, produced on the older branches, varies somewhat from round to oval in shape, and usually weighs from 5 to 7 lb., though sometimes as much as

Dillenia indica.—"HONDAPARA."

10 lb. It is armed with thickly set formidable prickles about ½ inch long; when ripe it becomes slightly yellow, and possesses an odour which is intensely offensive to most people, especially on first acquaintance with it. The cream-coloured pulp surrounding the seed is the edible portion; this is most highly prized by the Malays and other Oriental races, and is also relished by Europeans who acquire a taste for it. FIRMINGER described it as "resembling blanc-mange, delicious as the finest cream," whilst MR. RUSSEL WALLACE considered that "eating durians is a sensation worth a voyage to the East." The large seeds may be roasted and eaten

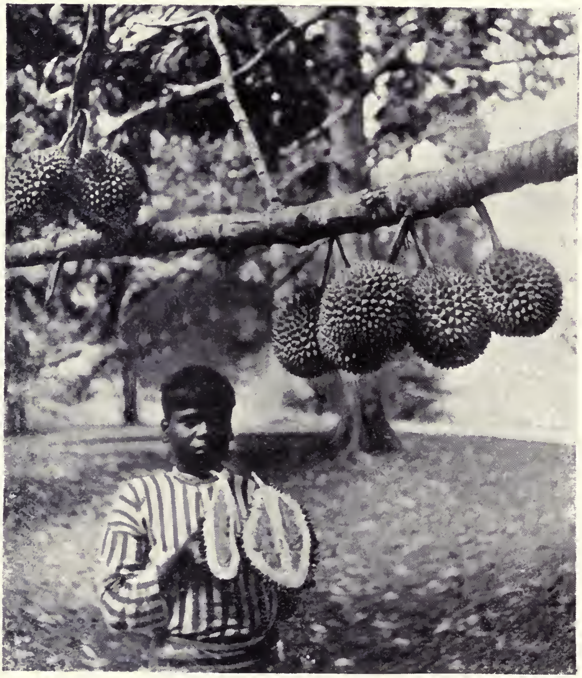
like chestnuts. Pounded into flour, they are said to be sometimes made into a substance like "vegetable-ivory." The Durian tree thrives in the moist low-country of Ceylon up to 2,000 ft. elevation, and luxuriates in deep alluvial or loamy soil. In Peradeniya

DURIAN-FRUIT.—*Durio zibethinus.*

Gardens there are magnificent specimens well over 100 ft. in height. They usually flower in March or April, and the fruit is ripe in July or August, but sometimes the flowering and fruiting period change with an abnormal season. Durian fruits are variable

in size, shape, flavour and quantity of pulp, according to variety. The trees also vary in productiveness, some varieties being almost barren. Selection and high cultivation should, therefore, be practised in order to obtain the best fruits. The tree is readily propagated by seed if sown fresh. The large fleshy seed is of short vitality, and germinates in seven to eight days (*See illustration*).

Elæocarpus edulis (Tiliaceæ).—A small ornamental tree, native of New Guinea, producing bright red fruit, which is 3 to 5



DURIAN FRUIT.—*Durio Zibethinus.*

sharp-angled, oval in shape, one-seeded, and nearly 2 inches long. The outer scanty rind (*pericarp*) is of a sweetish-bitter taste, and may be made into a savoury jelly or used for pickling. The tree is worth growing for ornament on account of its graceful foliage and handsome red fruits, but scarcely as a fruit tree. It thrives in shady places with loose rich soil, up to about 2,000 ft. Propagated by seed, which take several weeks to germinate.

E—serratus. Ceylon Olive ; " Veralu " *S.*; " Verali-palam," *T.*—A handsome medium-sized tree, indigenous to Ceylon, producing

smooth oval green fruits, of the size of olives, which they closely resemble. The fleshy portion surrounding the stone (seed) is sub-acid and palatable. In an unripe state it is excellent for pickling, like olives. The principal season for the fruit is April and May. The tree thrives in the moist low-country up to about 2,000 ft., and is propagated by seed.

Eugenia Jambos (Myrtaceae). Rose-apple; "Veli Jambo" *S.*; "Seeni Jambo" *T.*—A medium-sized handsome tree, native of India and Malaya, and introduced into Ceylon probably in the time of the Portuguese. Its fragrant pinkish-white or rose-coloured fruit, about the size of a hen's egg, is of a sweetish-acid taste, and is said to be sometimes used in preserves. As a fruit, however, it is usually of a very indifferent quality, being in some cases wooly and almost tasteless; but it varies somewhat with different trees and conditions of cultivation. The tree thrives best in moist districts, at medium elevations up to 3,000 ft., preferring a deep rich soil. Propagated by seed.

Eugenia javanica. Wax Jambo; "Peni-Jambo" *S.*—A small ornamental Malayan tree, producing clusters of very pretty, shining, rose-pink, or pinkish-white, waxy-looking fruits. Each fruit is about the size of a large strawberry, with the base laterally compressed; the pulp is edible, but is usually too fragrant and pithy to be agreeable. The tree is propagated by seed, and thrives best at elevations of 1,000 to 3,000 ft. in moist districts.

E.—malaccensis. Malay-apple; Jambo *S.*; "Peria Jambo" *T.*—A handsome tree 30 to 50 ft. high, with large leathery oval leaves, indigenous to Malaya. It produces a great profusion of beautiful crimson flowers, which for several days during January and February make a bright carpet under the tree as they drop. The pear-shaped white or bright red fruit are produced chiefly in May and June, these too making the tree an attractive object. The snowy white, but rather pithy, pulp surrounding the seed is edible, but not of much account. Propagated by seed. Thrives in the moist low-country up to 2,000 ft.

E.—Micheli. Brazil or Surinam Cherry; "Goraka-Jambo" *S.*—A small shrubby tree of Brazil, bearing small round and ribbed fruit, about 1 inch in diameter, rather flattened at the ends, and of a bright red waxy appearance. These suggest small tomatoes at a distance; the pulp is edible, but to most people is too acid and perfumed to be agreeable. It is said to make good jelly, being also used in preserves. The tree thrives best at medium elevations, 1,000 to 3,000 ft. Propagated by seed.

Feronia elephantum (Rutaceæ). Wood-apple or Elephant-apple; "Diwol" *S.*; "Vila" or "Vilatti" *T.*—A good-sized tree, 40 to 50 ft. high, native of India and Ceylon It bears round fruit, about the size of a large cricket ball, similar to the Bael-fruit but

LOVI-LOVI.—*Flacourtia inermis.*

distinguished from it by having a whitish warty surface. The hard woody shell encloses a mass of soft brownish mealy substance, which has a strong aromatic odour. The fruit is generally relished in Ceylon by the poorer classes, and is also used in native medicine.

Elephants, too, are fond of it. The tree is common throughout the dry region, being often cultivated there as well as in the moist low-country.

Flacourtia cataphracta. (Bixaceæ). "Rata Uguressa" S.—A small thorny tree, native of India and Malaya, producing round berries of the size of large cherries, purplish or deep-red in colour, and of a rather tart flavour. FIRMINGER thought it

"GORAKA."—*Garcinia Cambogia.*

"suggestive of something better than a sloe, but worse than an indifferent plum." There are, however, several varieties in cultivation, and some if properly cultivated merit a better description than the above. The fruit can be made into a very agreeable jam or preserve. Plants may be raised from seed, but a good variety should be budded or grafted.

Flacourtia inermis. Lovi-lovi, Tomi-tomi; "Louvi" *S.*—A Malayan, ornamental thornless tree, growing to about 30 ft. high, bearing in great profusion bright red, cherry-like berries, which are produced in two seasons, March to April, and August to September. The attractive looking fruits are deceptive, being exceedingly sour in taste; but they make excellent jelly and may also be used in preserves. The tree is propagated by seed, and thrives in any moderately good soil in the low-country. Sow the small seed in pots or boxes, under cover; prick out the seedlings into baskets or bamboo pots when large enough. The plants take about eighteen months to be ready for planting out (*See illustration*).

Garcinia Cambogia (Guttiferæ). "Goraka" *S*; "Korakkai-pulli" *T.*—A moderate-sized handsome tree, with a round head and drooping branches, native of the moist low-country of Ceylon and Western India. The large roundish fruit is of the size of an orange, with several (usually eight) deep vertical grooves, forming blunt lobes; it is smooth on the surface, red or orange-yellow in colour, and sweetish-acid in taste. When ripe (from June to July) it is commonly collected by the Natives in the low-country of Ceylon, the thick succulent shell being cut in sections, dried in the sun and preserved for use as required. It is largely employed for preserving fish, being made into a brine with salt; also used as a substitute for limes in curries. The tree thrives up to 2,000 ft. Propagated by seed.

G. Mangostana. Mangosteen; "Mangus" *S.* "Mangus-kai" *T.*—A moderate-sized conical tree, with large leathery leaves, indigenous to Malaya. Its globular purplish brown fruit, about the size of an apple, is famed as one of the most delicious fruits of the tropics, some writers describing it as "perhaps the most luscious fruit in the world, partaking of the flavour of the strawberry and the grape." The delicate white juicy pulp surrounding and adhering to the seed is the part eaten. In striking contrast to it is the dense, thick, reddish rind, containing tannic acid and a dye. The fruit is in season in the low-country of Ceylon from April to June, and at higher elevations from June to August or September. Here it is usually sold in the markets, or hawked about, at 75 cts. to Re. 1 per dozen; it is always charged for on hotel menus as an *extra*. The tree is of very slow growth, and does not usually come into bearing till about nine or ten years old. The essential conditions for it are a hot, moist climate, and deep, rich well-drained soil. It thrives up to 1,500 feet elevation in the moist region, but

may also be grown in moderately dry districts with irrigation. Propagation is usually by seed, but may also be effected by "gootee"

MANGOSTEEN FRUIT.—*Garcinia Mangostana.*

or layering. Sow seeds in pots under cover. The plants are of very slow growth, taking about two years to become large enough for planting out, being then only about 12 inches high.

Garcinia Xanthochymus. "Cochin-goraka," or "Rata-goraka" *S*; "Seemai-goraka" *T*.—A symmetrical, cone-shaped bushy tree, growing to 25 or 30 ft. high, native of South India and Malaya. It bears large leathery leaves, 12 to 16 in. long and 2½ to 3½ in.

RATA, OR COCHIN-GORAKA.—*Garcinia Xanthochymus.*

in width. The handsome yellow fruit, produced in great abundance in December and January, is of the form and size of a small orange, usually with a pointed projection at the end, the tender thin skin being smooth and polished. The yellow juicy pulp is of an acid, but refreshing taste. The tree is propagated by the large seeds, and thrives up to about 3,000 ft. or more.

Grias cauliflora (Myrtaceæ). Anchovy Pear.—A small slender, unbranched West Indian tree, with a crown of very large drooping leaves, the latter measuring up to 3 ft. in length by about 6 to 8 inches across. The brown oval fruit, produced on the stem, are of the size of a hen's egg, and in the West Indies are considered to resemble the mango in taste, being said to be used for dessert and pickling. The quality of the fruit produced by the trees at Peradeniya does not, however, warrant such a high opinion, and are seldom eaten. MR. HARRISON, of Jamaica, also concurs in this view. Propagated by seed.

Hibiscus Sabdariffa (Malvaceæ). Jamaica or Red Sorrel; "Rozelle;" "Rata-bilincha" *S*; "Pulincha-kira" *T*.—An annual shrub, 4 to 5 ft. high, with reddish stems, leaves and fruit, native of the West Indies. It is cultivated in most warm countries (sometimes as an intercrop with other products) for the sake of its large fleshy sepals, which remain after the flowers fall away (*persistent*), and become enlarged and succulent (*accrescent*), enclosing the fruit-capsule; these make excellent jam, and a jelly is also made from them which is considered to be almost equal to red-currant jelly. In an unripe state the fruit is adapted for pickles, and a refreshing beverage called "Sorrel-drink" is also prepared from it. The young tender acid leaves are esteemed by the Natives of Ceylon as a vegetable in curries, and the stems afford a quantity of strong fibre. The plant thrives at elevations up to 2,500 ft. with moderate rainfall. Seeds may be sown at the commencement of the monsoon rains, and the seedlings, when ready, planted out in rows about 6 ft. apart, with about 4 ft. between the plants in the row. The sepals should be fit for picking in 3 to 4 months from the time of planting, and the plants will continue to produce these for about two months. The plant occurs in two varieties, viz., "White Sorrel" with greenish-white, and "Red Sorrel" with reddish sepals, the latter variety being considered to be the more acid, and generally preferred.

Inocarpus edulis (Leguminosæ). Tahiti-chestnut. A moderate-sized tree with large shining leaves, indigenous to the Pacific Isles. The large fleshy seeds, of which one or two are contained in a stout pod, are edible, and said to form an important article of food to the Natives in the tree's indigenous home. When boiled and roasted, the seeds are considered palatable, though "not suited to weak stomachs." The tree thrives and produces flowers and fruit at Peradeniya, where it has been introduced in 1861, but the fruit is not eaten here. Propagated by seed.

Lansium domesticum (Meliaceæ). "Langsat," or "Lanseh," "Duku," (Malayan names).—A moderate-sized ornamental tree, native of Malaya. It bears long pendant clusters of closely packed berries, which have a thin tough skin, are pale yellow when ripe, enclosing opaque aromatic juicy pulp. This fruit is said to be much relished in its native country, being "eaten fresh or variously prepared," and Dr. Ward described it as one of the finest fruits of the Malayan Peninsula. Judging, however, by the product of a tree growing in Peradeniya Gardens, it by no means justifies so meritorious a description, and I can only suppose that this must be an extremely poor variety. The tree does not seem to be much known in India. Propagated by seed. Will thrive up to 2,000 ft. in moist districts. Introduced at Peradeniya in 1869.

Lecythis oleracea (Myrtaceæ). Sapucaia-nuts.—A large forest tree of Brazil and Guiana, closely allied to the Brazil-nut. The long wrinkled nuts (seeds), which are contained in a large brown woody shell, are regarded as superior to the latter in delicacy and flavour. Contrary to the Brazil-nuts, the fruit is furnished with a distinct lid, which when ripe becomes detached and lets the seeds fall out. Owing, therefore, to the difficulty of collecting these, they command a higher price than the Brazil nuts.

Lucuma mammosa (Sapotaceæ). Mammee Sapota; Marmalade-fruit; Sapote, or Grosse-Sapote.—A tree 30 to 40 ft. high, with fulvous or grey branches, and long obovate pointed leaves, native of Central America, and cultivated in the West Indies for its fruit. The cream-coloured, silky flowers are borne in clusters on the stem. The fruit is about 6 inches long, with reddish pulp, containing one or more polished seeds. The pulp is sweet, and resembles in taste a luscious pear. It is made into a marmalade, which is said to be not unlike good apple preserve. The common names of this tree are often confused with those of the tree *Mammea americana*, which see over.

Macadamia ternifolia (Proteaceæ). Queensland-nut.—A moderate-sized tree, about 40 ft. high, with dense dark-green foliage, native of North Eastern Australia. It bears very hard nuts, of the size of marbles, on spikes 5 to 8 inches long; the nuts are edible and of an agreeable flavour, being much relished in Australia, and sometimes retailed in Sydney at from 8*d*. to 1*s*. per lb. The extremely hard shell, which requires a considerable pressure to break, is, however, a drawback to these. The tree is propagated

by seed; thrives and bears fruit at Peradeniya, where it has been introduced in 1868. Suited to medium elevations.

Mammea americana. (Guttiferæ, Mangosteen family). Mammee-apple; St. Domingo-apricot.—A moderate-sized tree, 40 to 50 ft. high, with large, rigid, leathery, shining leaves, and white, scented flowers, native of tropical America and the West Indies. The fruit is nearly spherical, 3 to 5 inches in diameter, with thick brown bark-like skin, containing one (sometimes more) large seed. Towards the apex of the fruit is usually developed a distinct pointed nipple. The seed is covered with a layer of fibre, which is surrounded by dense, orange-coloured, sweetish and slightly aromatic pulp. The latter may be eaten raw or stewed, or preserved with sugar. The small flowers are cream-coloured and scented, and a distillation of these is used in flavouring the spirituous liquor known as *Eau de Creole*. DR. LINDLEY referred to this fruit as the "Wild Apricot of South America, said to rival the Mangosteen;" while MACFADYEN described it as "of a sweetish aromatic taste, bearing a resemblance to that of carrots." The tree has been established at Peradeniya since about 1810, and bears a crop of fruit annually, but here the fruit is sought after more as a curiosity than on account of its flavour. Propagated by seed.

Magnifera indica. (Anacardiaceae). Mango; "Amba" *S*; "Manga" *T*.—A medium or large-sized tree, of a spreading and quick-growing habit, indigenous to tropical Asia. It bears large panicles of greenish-white, scented flowers, usually in January, February, or March, followed three or four months later by the fruit. The latter is generally oval in form, somewhat flattened, often with a more or less pronounced beak at the apex. It may weigh from 6 oz. to 2 or 3 lb., has a tough thin skin, and, when ripe, is yellow, reddish, or green. The flesh is usually of a reddish tint, with a more or less sweet, turpentine flavour, sometimes resinous and fibrous. In the centre is the large fibrous seed. The Mango is the fruit *par excellence* of India, where it has been cultivated from time immemorial. Here it may be considered an article of food as well as dessert, while it also enters largely in the preparation of chutneys and other preserves. The tree grows from sea-level to about 4,000 ft. or more, but is scarcely fruitful at elevations over 2,000 ft. in Ceylon. A hot and rather dry climate and a rich, well-drained soil suit it best. The trees should be irrigated during prolonged drought, and receive a good mulching once a year. *Pruning* is confined to thinning out superfluous or

sickly branches; while *root-pruning* is sometimes applied with advantage to trees which are unfruitful (owing to their running too much into wood and leaf), this being performed by cutting a deep trench round the tree at a few feet from the stem, cutting clean all roots met with. Shade is not necessary, except when the plants are young. Propagation is best by inarching or layering, the gootee method being commonly adopted in India. Propagation of the mango by budding may also be successfully effected (see under

"JAFFNA," OR ALPHONSO MANGO.

Propagation). Plants are easily raised from seeds, and if care be exercised in selecting the best fruits from choice varieties, these may become good fruitful trees. Some varieties are said to come more true to seed than others. Frequently, however, seedling trees are liable to be disappointing in the quality of their fruit, and they take much longer to come into bearing than layered or grafted plants, the latter commencing to bear fruit in their fourth or fifth year. Before planting out, large holes, not less than 3 by 3 ft., should be dug, mixing a good proportion of well-rotted manure with the

soil for filling in. The distance for planting the trees apart should be not less than 25 ft. each way.

VARIETIES.—There are numerous varieties of the mango in cultivation, the fruit varying in point of flavour, juiciness and succulency, size and shape of seed, etc. Varieties are occasionally

PRINCIPAL TYPES OF MANGOES GROWN IN CEYLON.

1—Rupee mango (not full size)
2—Jaffna mango
3—"Betti," or "Bombay" mango
4—Parrot mango
5—Mi-amba (Honey mango)
6—Et-amba (seed mango)
7—Smaller variety of Et-amba

met with which are nearly seedless, that is, the majority of the seeds are in an imperfectly developed state. Different names are sometimes given to the same varieties in different countries. In Ceylon there commonly occur the following five distinct types, but

of these there are numerous sub-varieties :—

Rupee.—Very large and somewhat round, pulp luscious and free from fibre, similar to "Cowasje Patel," or "Inerma" of India.

Jaffna.—Large oval fruit of excellent quality when well-grown ; probably equal to "Alphonso" of India.

Parrot, "*Gira-amba*" S.—Medium-sized oblong fruit, with a distinct beak, piquant and pleasant flavour.

Bombay or "*Betti-amba*," S.—Round and rather flat, very juicy, yellow when ripe.

Dampara.—Fruit rather small and flat, very sweet ; must be eaten quite ripe.

Honey, or "*Mi-amba*" S.—A small roundish fruit of a sweet flavour.

Seed-mango or "*Et-amba*" S.—A small oval fruit, with scanty juicy pulp, of a distinct piquant flavour.

"*Maha-mudaliyar*," or "*Puhu-amba*" S.—A very small seedless fruit, with sweet juicy pulp. See *seedless mango* below.

The following are a few, out of a great number, of the principal Indian Mangoes :—

Afonza.—Greenish yellow with dark specks, about 18 oz., very sweet.

Alphonso.—About 12 oz., 4 in. by $3\frac{1}{4}$ in., pulp of the finest piquant and delicate flavour. Generally considered the best of all mangoes.

Banchore of Dhairey.—Yellow, 3 in. by $2\frac{1}{2}$ in., very sweet.

Borsha.—Oblong, bright green with yellow spots when ripe ; up to 10 oz., delicious flavour.

Custodio.—Very large, yellowish-green, free from fibre.

Mulgoba.—Fairly large, yellow and green blotched, no fibre, flavour piquant and sweet.

Pakria.—Medium-sized, rich crimson, pulp deep yellow.

Ryotya.—Bright crimson, weight about $\frac{1}{2}$ lb., extra fine flavour, no fibre.

Salgadina.—Medium-sized, rich crimson, pulp deep yellow.

Caraboa is about the best mango in the Philippines, the *Pico* ranking next to it in quality ; both are bright yellow when ripe.

Pahutan,—also a highly-flavoured mango of the Philippines ; recommended as a stock for grafting on, owing to the great vigour and size of the tree.

Sundersha.—Large clear yellow, with a distinct beak, juicy and tender, free from fibre.

Totapari.—Medium-sized, slightly fibrous, of excellent flavour.

A seedless mango of a very pleasant flavour, which is reported as occurring in Hawaii, would appear to be similar to the *Puhu-amba* or "*Maha-Mudaliyar*" mango of Ceylon.

Melicocca bijuga. (Sapindaceæ). "Honey Berry," Spanish Lime, Ginep, Mamoncillo (Cuba).—A large handsome tree of South America with pinnate leaves, introduced and cultivated in several West Indian Islands. It produces numerous green small oval

fruits about an inch in length, possessing an aromatic sweet taste. Usually too small to be worth eating, though said to be appreciated and much consumed in some localities, especially in Cuba. Introduced to Peradeniya in 1907.

Mimusops Bojeri (Sapotaceæ).—A slow-growing tree with small ovate or obovate leathery leaves, shiny above and satiny grey beneath. The fruits, produced in November and December, are of the size of small plums, borne in clusters at the ends of the branches; each fruit contains from 2 to 4 large oblong brown seeds; the pulp, surrounded by a thin skin, has a sweet taste, not unlike the Sapodilla plum. The tree contains a white gummy latex, thrives in Ceylon up to 1,500 ft. elevation, and is propagated from seeds.

Monstera deliciosa. FRUIT EDIBLE.

Monstera deliciosa. (Aroideæ, Arum family).—A noble epiphytic creeper with large, scolloped and perforated leaves, native of Mexico. It produces in the axils of the uppermost leaves a cone-like fruit (*spadix*), 6 to 8 inches long, which is edible and has a pleasant odour when ripe. The fruit has an agreeable flavour suggesting a pine-apple, but is rather juiceless. Its chief drawback, however, is the presence of minute black spines attached to the inside portion, which cause a disagreeable itching in the throat. The plant is a creeper, and requires stout tree trunks to grow upon. It may be readily propagated by placing cuttings in a mixture of old bark, leaf mould and coir-refuse at the base of the tree on which

it is to grow. After getting a firm hold of the tree it requires no further attention.

Musa sapientum (Scitamineae, Ginger family). Plantain or Banana: "Kehel" *S.* "Vala" *T.*—A small quick-growing tree 10 to 20 ft. high, with a herbaceous stem composed of the succulent

"SUWANDALE" PLANTAIN OR BANANA.

leaf stalks. As regards utility combined with magnificence, this must be considered one of the most remarkable of tropical products. When the plant is about eighteen months old the enormous flower-stalk issues from the centre of the crown of leaves, and curves over with its own weight. The flowers are in clusters, and alternate with large reddish succulent scales; the latter drop off as the fruit stalk develops, and the ovaries of the flowers rapidly

grow into large finger-like fruits, which are borne in *combs* or clusters. The banana fruit, or plantain, as it is generally called in the Eastern Tropics, may be said to be to the inhabitants of the torrid zone what bread and potatoes are to those of the North temperate zone. It is a highly nutritious and easily digested food, containing practically all the elements necessary to the human body; according to *The Lancet*, the starch of the banana is much more digestible than are the cereal starches. The tree will grow in any ordinarily good soil, provided it is sufficiently moist and well-drained; it is essentially suited to a hot and moist climate, but will also thrive in a dry climate under irrigation, and up to 5,000 ft. in sheltered valleys. A windy situation and a sandy calcareous soil are both unsuited to it. Propagation is effected by offshoots or suckers, and these may be planted out direct at a distance of 12 ft. by 12 ft. apart, good large holes, filled with well-manured soil, being first prepared for them. Fertile seed is rarely produced by cultivated varieties. The plant will throw out several suckers, forming a clump, which should not be allowed to exceed five or six stems. The clumps should from time to time be moulded up with surface soil and any mulch of leaves, etc., available. The first bunches of fruit may be obtained about a year from the time of planting, while the subsidiary suckers produce fruit when from twelve to sixteen months old. Each stem as it fruits dies, and others take its place, the clump thus continuing productive for several years. Under good tillage, an acre is considered to produce 300 to 400 or more bunches annually. The plants will respond well to manuring and deep tillage. An application of a mixed fertiliser composed of (for an acre) 200 lb. sulphate of potash, 250 lb. sulphate of ammonia and 450 lb. superphosphate, is recommended by growers in the West Indies. All leaves and trash should be returned to the soil.

VARIETIES.—A great number of varieties occur in cultivation. Of those grown in Ceylon the two best are doubtless *Suwandel* and *Kolikuttu*. Less superior kinds are, however, the most cultivated (because the most prolific and easiest of cultivation), such as *Embul-hondarawala*, *Anamalu*, and *Rath-kehel*, or forms of these.

The following are the principal varieties met with in Ceylon :—

Anamalu (fingers stout, rather angular, sub-acid, large bunches); *Bin-kehel* or *Dwarf plantain* (similar to *Anamalu*, fingers thickly set, smooth yellow skin); *Embul-hondarawala* (most common kind met with in markets and bazaars, fingers straight, fragrant, sub-acid); *Koli-kuttu* (fingers large and stout, loose-skinned, sweet,

mealy, produced in large bunches; *Puwalu* (fingers thin and rather angular, somewhat acid); *Ranel* or *Red Plantain* (large red fingers, borne in huge clusters; coarse, thick-skinned, mealy; chiefly grown in the North of Ceylon); *Rata-hondarawala* (thickly set combs; angular stout fingers, sweet); Rath-kehel (short, smooth, round fingers, rather acid but pleasant); *Suwandel* (thin-skinned, tender and sweet, considered the best in Ceylon; not commonly grown for market).

While almost all the above may be cooked in an unripe state and used as a vegetable, the following are used chiefly for that purpose only, although some are also eaten raw when ripe, viz., *Alu-kehel* or *Ash Plantain* (slender stems; fingers stout and angular, covered with a greyish bloom); *Marthamalu* (short, stout, thick fingers, resembling Anamalu in taste), *Nawari* or *Wandaru-anamalu* (long, thin greenish-yellow fingers; dark slender stems); *Puspakadali* (short stout fingers, thin-skinned; suited for dessert); *Suramondan* (large green angular fruit, borne in huge clusters). *Gros Michel*, also known as the "Jamaica" or "Martinique" banana, is said to be the principal variety grown in Jamaica (and apparently also in Hawaii, Cuba, etc.) for export.

Musa Cavendishii; "Dwarf" or "Chinese banana," native of South China, is the one so largely cultivated in the Canary Islands and exported to England, etc. It is also said to be the one now chiefly grown in Barbados.

While in the Eastern Tropics all bananas are known as plantains, in the West Indies the name "plantain" is applied only to cooking varieties.

Nephelium lappaceum. (Sapindaceæ). "Rambutan; "Rumtum" *S.*—A large handsome spreading tree, native of Malaya, yielding a profusion of bright red or orange-yellow fruits, the latter being produced in large clusters suspended from the ends of the branches, presenting a very ornamental effect. Each fruit is of the size of a large gooseberry, covered with long soft coloured spines, the interior being occupied by a large seed, surrounded by a layer of white opaque pulp (*aril*), which is of an acidulous agreeable taste. Birds and bats are particularly partial to it. It is curious that this fruit, which is so common in the low-country of Ceylon and in the Straits, appears to be scarcely known in India, Mauritius, Madagascar, etc. The tree is readily propagated from seed, but the best varieties should be raised by grafts or gootees. Thrives up to 2,000 ft. elevation.

Nephelium chryseum (or N. mutabile); Pulassan.—A Malayan tree, similar to the rambutan in appearance, but differing in the fruit and in the leaves being grey beneath. The fruit is larger than the

rambutan, of a deep purple brown, with short blunt processes, and, according to RIDLEY, the flavour is decidedly superior to that of the latter fruit.

N.—Litchi. "Litchi," or "Litchee."—A small bushy tree, with handsome dense foliage, native of China. It blossoms in the dry season (about February), producing sprays of pale-green flowers, and ripens its fruit about June. The fruit, produced in clusters, is of the size and form of a large plum, with a rough, thin warty rind, which becomes of a beautiful red tinge, gradually turning to a dull brown colour before it is quite ripe. The jelly-like pulp or aril

RAMBUTAN.—*Nephelium lappaceum.*

which covers the seed is of a translucent whiteness and of an agreeable refreshing flavour. This fruit, represented by different varieties of varying quality, is grown to great perfection about Calcutta and elsewhere in India, and is commonly sold in the bazaars when in season. CAMERON says it thrives up to 3,500 ft. in South India, giving at Bangalore two crops of fruit a year (in May and December). It is grown successfully in Mauritius, but, curiously, is rarely met with in Ceylon, though introduced here as early as 1802. The tree flourishes and produces fruit at Peradeniya, but the variety grown here is obviously an indifferent one. There are several varieties in cultivation, distinguished by size and shape

of fruit, quality of pulp, and size of seed. Litchi fruits are dried and preserved in China and Cochin China, from whence they are exported to Europe and America. Dried litchis are of a sweetish

LITCHI FRUIT.—*Nephelium Litchi.*

acid taste, and when deprived of the brittle shell rather resemble raisins. The tree may be multiplied by sowing seed, but budding or grafting should be adopted to propagate the best varieties.

Passiflora laurifolia (Passifloraceæ, Passion-fruit family). Water-lemon; "Jamaica Honey-suckle," "Pomme d'Or," or

"Bell-apple."—A handsome West Indian climber with laurel-like foliage, said to be cultivated in its native home for its fruit, which are much esteemed for dessert. The plant appears to have been introduced at Peradeniya before 1824, but although it grows and flowers freely here, it has not yet set fruit, neither does it seem to

GRANADILLA.—*Passiflora quadrangularis.*

be fruitful elsewhere in the East. The fruit is of the size and shape of a hen's egg, with a smooth yellow rind when ripe, containing sweet watery pulp. The plant is readily propagated by cuttings, and is especially adapted for growing as a screen on the sides of plant-houses. Light humous, well-drained soil suits it best.

P.—edulis. Passion-fruit. (See *Sub-tropical Fruits.*)

Passiflora quadrangularis. Granadilla; "Garandilla" or Ratapuhul, *S.*; "Seemai-sorakai" *T.*—A strong quick-growing climber, with large oval leaves and square stems, native of tropical America. Its large oblong greenish-yellow fruit is not unlike a short and thick vegetable-marrow, and contains in its hollow centre a mass of purple, sweet-acid pulp mixed with the flat seeds. In the unripe state the succulent portion of the fruit may be boiled and used as a vegetable. The root is usually swollen and fleshy, and is sometimes eaten like a yam. The flowers are generally fertilised by insects, but these should be aided by artificial fertilisation by hand, so as to ensure a larger crop of fruit. When the fruit is over, the shoots should be well cut back, retaining little but the stem. The plant is propagated by either seed or cuttings, and thrives up to about 3,000 ft. in Ceylon. It should be trained over a fence or trellis-work, or allowed to climb trees with low spreading branches.

Persea gratissima. (Lauraceæ). Avocado Pear; Alligator-Pear; Soldier's Butter; "Et-pera" *S.* "Anakoya-pallam" *T.*—A small tree, 25 to 30 ft. high, native of tropical America. The fruit is a salad rather than dessert; it is ordinarily green, but acquires a yellowish or pinkish tint when ripe. It is of the form of a large pear, with a very thin tender skin, and contains in its hollow centre a large round fleshy seed. Between this and the rind is a thick layer of greenish-yellow pulp, of the consistency of firm butter, and somewhat resembling walnut in flavour; this may be scooped out with a spoon and eaten either plain or flavoured with salt, pepper and vinegar; it is much esteemed by many people and considered wholesome. The fruit should be picked before it is quite ripe, and kept for a few days to become slightly soft. The tree is now commonly grown in the Eastern tropics, as well as in Florida, Queensland, Madeira, Natal, etc. The fruit is very popular in the United States, and is also imported into London, to a small extent, from the Canary Islands. It is very susceptible to injury by bruising, and therefore rather difficult of transport, the least bruise causing a black mark. The tree thrives best, in Ceylon, at medium elevations, where it bears fruit abundantly, chiefly from July to August. There are several distinct varieties in cultivation, the fruit of these varying in shape, size, thickness, colour of the skin, etc. While in some it is smooth and green, in others it is warty and crimson. A good tree will bear from 600 to 800 or more fruits a year, and each fruit may weigh

from 1 lb. to as much as 2 lb. Propagated by grafting or seed, which should be selected and sown as fresh as possible.

Phoenix dactylifera (Palmae). Date Palm.—A sub-tropical, diœcious palm, attaining a height of 60 to 80 ft. or more, with stiff feathery leaves, extensively cultivated for its fruit (the dates of commerce) in Northern Africa, North-Western Asia, and the Mediterranean region. All parts of the palm are used for different domestic purposes, as in the case of the coconut-palm in the torrid

AVOCADO PEAR.—*Persea gratissima.*

zone. Dates are a standard article of food with the inhabitants of the countries above named, being also used as food for animals. Here the cultivation of the fruit forms a large and important industry, it being dried or preserved and largely exported. The chief requirements of the Date-palm are: great heat for a certain period of the year, a dry atmosphere, and a sandy soil. In the region where it is indigenous or cultivated, the temperature in summer sometimes reaches 100° Fah., whilst in winter it goes

down to freezing point. An annual rainfall of 5 to 10 inches is sufficient, but no rain should fall during the fruiting period, viz., June to October. The palm requires, however, a constant supply of water at the roots, and the water may be brackish, but not stagnant. The trees are planted about 25 ft. apart each way, or 70 trees to the acre. Before planting, deep and sunken pits for the plants should be prepared; these are at first only partially filled, preferably by light rich soil. The plants should be shaded and protected after planting, and the soil kept moist by watering until they have become established, and put on fresh leaves. The best time for planting is at the commencement of the rainy season. The Date-palm has of late been largely planted in the Southern United States and Queensland. Its cultivation in Northern India is reported to be only partially successful, whilst in Ceylon and the Straits it has so far proved a failure. A Date-palm in the Royal Botanic Gardens, Peradeniya, has grown to a height of about seventy feet, being now some 65 years old, but has never flowered. Propagation may be effected by seeds or off-shoots, the latter means being usually adopted, as seedlings cannot be relied upon for the quality of fruit produced, nor can the male be distinguished from the female plants until they have flowered. Only female trees are productive, and their flowers must be fertilised by those of the male tree. The trees bear off-shoots as a rule only between the ages of six and sixteen years. Off-shoots are not removed from their parents until three to five years old. When planting these out, one male off-shoot is planted to every 50 or 100 "females," this proportion being considered sufficient to secure the fertilisation of the flowers of the latter. The latter process is sometimes assisted by hanging the male inflorescence above the flowers of the female tree for a few days; the dates are ripe and ready to gather about four months after pollination of the flowers. The palms come into bearing in 5 to 7 years, but are not in their prime until 20 years old. A good tree will produce from 150 to 200 lb. of fruit per annum, and may continue productive until it has reached the age of 80 or 100 years. After attaining this age the palms are used only for extracting toddy (fermented juice), which is obtained by means of incisions made in the crown of the tree. The toddy, being fermented and distilled, yields an intoxicating beverage or arrack. There is a large number of varieties of dates in cultivation, amongst the best being *Deglet Noor*, *Khadramee*, *Hallawee*, *Sayer*, *Zahdee*, and *Derec*.

Photinia (Eriobotrya) japonica. (Rosaceæ, Apple family). Loquat; Japanese-medlar.—A tree of medium size and symmetrical habit, with large handsome leaves, which are wooly-white underneath, native of China and Japan. It is cultivated in most warm countries for its small oval yellow fruits, which are of the size of crab apples and have a sweetish acid flavour, and are especially suited for stewing. There are different varieties of Loquat, but the merits of each depend largely on cultivation. The dingy white flowers are delightfully fragrant. The tree thrives from about 2,000 to 5,000 ft. elevation in the tropics, and likes light rich soil, with good drainage. Plants are raised readily from seeds, but superior varieties should be propagated by budding and grafting.

Phyllanthus distichus. (Euphorbiaceæ). Otaheite Gooseberry; Star-gooseberry; "Rata-nelli," or "Siri-nelli" *S.*—A shrub or small tree, with long graceful feathery leaves, native of India and Malaya, and often cultivated in low-country gardens in Ceylon It bears a pale green, round, ribbed and acid fruit, with a hard seed in the centre. The fruit is commonly used by the Natives for pickling; cooked with sugar it makes a delicious preserve. A crop is produced twice a year, in April and August. Propagated by seed. Suited only to the moist low-country.

P.–Emblica. "Nelli" *S.*—(See under *Sub-tropical Fruits*).

Psidium Guyava (Myrtaceæ). Guava; "Pera" *S.*; "Koiya-pallam" *T.*—A spreading shrub or small tree, ten to fifteen feet high, native originally of tropical America, but now thoroughly naturalised in Ceylon, India, Malaya, etc. In Ceylon, a wild form of Guava frequently comes up as a weed in waste ground and in the poorest soil, bearing small round berries, chiefly from November to January; these are pale yellow when ripe, and are sold in the boutiques or hawked about under the name of "Embul pera" (at about 3 to 5 cts. per hundred); they are used for stewing and for making tarts and jelly. The best cultivated varieties have a large juicy fruit, round or oval in shape, becoming a lemon-yellow colour when ripe. The tender skin encloses a reddish or yellowish pulp (which has a sharp tart flavour), towards the centre of which the numerous small seeds are embedded. The chief use of the fruit is for making the noted guava jelly. Propagation of the tree is easily effected by seed or suckers, but budding or grafting should be resorted to for the best varieties. The Guava thrives at all elevations up to 4,000 ft. or higher, and flourishes in ordinarily good soil. The variety *Pear Guava* bears a large oval succulent

fruit, of the form of a lemon, with a smooth yellow rind and pale-green, scented pulp. *Kaffree* or *Kaffir Guava* is distinguished by a large warted and furrowed fruit, not unlike a Citron in appearance. *Apple* or *Red guava* (*P. pomiferum*) is similar to the *Pear Guava*, but differs in having a round fruit with reddish pulp.

Psidium Guineense. Guinea Guava.—A shrub, eight to twelve feet high, native of Guinea. The fruit is described as "a fulvous berry, red inside, about the size of a nutmeg, and of an exquisite taste."

P.—Cattleyanum.—(See under *Sub-tropical Fruits*).

Prosopis dulcis (Leguminosæ). Algarobo-, Cashaw-, or Mesquit Bean.—A deciduous thorny shrub or tree, 30 to 40 ft. high, with small bi-pinnate leaves, native of Central and South America. The sweetish succulent pods, which are similar to "Carob beans," are edible, but are chiefly used for feeding cattle. Probably suited for the dry zone. Propagated by seed. The tree has apparently not yet been established in Ceylon.

P.—julifera. Similar to the foregoing species.

P.—pubescens. Tornilla or Screw-bean.—A small tree of Texas, Mexico, etc., similar to the foregoing species in general characters.

P.—spicigera. A small tree, resembling *P. dulcis*, native of Northern India, where its sweetish farinaceous pods form a valuable article of food in times of scarcity. They are eaten green or dry, raw or boiled, with salt and onions, etc., and are also used as fodder for cattle. Suited for the dry zone only ; not yet established in Ceylon. See under *Fodder Plants*.

Punica granatum. (Lythraceæ). Pomegranate ; "Delun" *S.* "Madalankai" *T.*—A small ornamental tree, with large beautiful scarlet flowers, native of Northern Africa and South Europe. It is commonly met with in gardens throughout the East, thriving especially near the sea, but also to some extent up to about 4,000 ft. elevation. The fruit is of the size of a large apple, with a tough rind, of a yellowish colour, tinged with red when ripe, (sometimes bright red or orange-yellow) and crowned with the persistent calyx lobes. The succulent, juicy coating of the numerous seeds is sometimes of a sweet acid taste, but often very bitter and astringent. In the tropics, the fruit is usually inferior to that grown in its native country, and in some cases seems to contain nothing but a quantity of closely packed seed with a little astringent juice. Superior varieties, however, occur in cultivation, some being described as "almost seedless, very sweet, deliciously

perfumed, and as large as an infant's head." The best fruits I have seen in Ceylon were grown on the dry sea-coast of Puttalam. Propagation is best by budding or grafting, though plants are easily raised from seed.

Sandoricum indicum (Sapindaceæ). Santol.—A handsome lofty tree of Malaya, producing in June and July large clusters of yellow globular fruits, not unlike small oranges at a distance. Like the Rambutan, the soft white aril covering the seeds (five) is of a somewhat agreeable acid and refreshing taste; fermented and mixed with rice, an intoxicating drink is prepared from it in its native country. The tree thrives in hot and moist districts up to about 2,000 ft. or more, and is worth growing for its ornamental effect. Propagated by seed.

Sarcocephalus esculentus (Rubiaceæ). Negro-peach; "Rata-bakmi" *S.*—A robust semi-climbing or spreading shrub, native of West Tropical Africa, and introduced at Peradeniya in 1883. Its soft brownish warty fruit, produced chiefly in July and October, is about the size of an apple; the soft reddish watery pulp is edible, but insipid, and the fruit is hardly worth considering amongst edible kinds. Propagated by seed or cuttings; thrives up to 2,000 ft. elevation.

Spondias dulcis (Anacardiaceæ). Otaheite-apple; "Ambarella" *S.*—A small tree with handsome foliage, native of the Society Islands, etc. The oval-shaped fruit is of the size of a large hen's egg and of an amber colour when ripe; it has a large stone (seed) in the centre, which is covered with coarse fibre and a scanty, very acid pulp, "with a flavour like that of an exceedingly bad mango." Notwithstanding, however, a high reputation given the fruit by some writers, it seems hardly worth a place in a fruit collection, unless for stewing, or for use in making jam or preserves. Propagated by seed, and suited to the moist low-country.

Sorindeia madagascariensis (Anacardiaceæ). "Manguiera à grappes."—A large tree of the mango family, with pinnate leaves, native of Madagascar, Zanzibar, and East Tropical Africa. It is said to be sometimes cultivated for the sake of the fruit, which is oval in shape, about one inch long, and of a sweet taste with a turpentine flavour. Introduced at Peradeniya in 1911, through Mr. Regnard, Mauritius.

Tamarindus indica (Leguminosæ). Tamarind; "Siyambala," *S.*; "Pullium" *T.*—A large handsome upright tree, with fine feathery foliage, native of tropical Asia and Africa. It is commonly

cultivated throughout the warmer parts of India, Ceylon, and Malaya both for its shade and excellent timber, as well as for its fruit. The latter consists of a brownish pod, 3 to 4 inches long, containing a mass of sweetish acid brown pulp. These pods form the "Tamarinds" of commerce, which are used in European as well as in Native medicine. The pulp is pressed and preserved in large masses, being commonly sold in the kaddies or bazaars by weight. It is esteemed for flavouring various dishes, while tamarind-wine and other cooling beverages are prepared from it. In the northern part of Ceylon, it is made into a brine for preserving fish. The principal season for the fruit is from January to February. The tree thrives in moist as well as dry districts up to about 2,000 ft. elevation, and in the dry northern part of Ceylon is commonly planted as a shade-tree for road-sides. Several varieties are recognised in India. The tree is readily propagated by seed.

Telfairea pedata (Cucurbitaceæ). Telfaria-nuts ; "Mkweme."—A climber with a slender woody stem, reaching a height of 50 to 80 ft., native of Zanzibar and East Tropical Africa. The fruit attains a size of one to two feet or more in length, and eight or ten inches in thickness, containing a large number of flat nearly circular seeds, each about 1½ inches across. These latter are also eaten, either fresh or dried in the sun and roasted ; they are said to be very palatable, and to contain about 36% of oil with a value equal to that of olive oil. Propagated by seed, which germinate within a week.

Terminalia Catappa (Combretaceæ). Indian-almond ; "Kotamba" *S.*; "Kottai" *T.*—A spreading tree, thirty to fifty feet high, with large leathery leaves, native of Malaya. The fruit is of the size of a plum, compressed on two sides, and contains a kernel which is much relished and used for dessert in India. Firminger considered it to be "beyond comparison the most delicious nut of any kind the country affords." The tree is deciduous twice a year, and bears two crops of fruit annually before dropping its leaves, i.e., in June and November. It thrives up to about 2,000 ft. in moist as well as rather dry districts. Propagated by seed.

Trapa bicornis (Onagraceæ). Water Chestnut ; "Ikiliya" *S.*—An aquatic plant, common in the tanks of the dry region of Ceylon, also in Bengal, Malaya, and Tropical Africa, Firminger stated : "Much cultivated in many parts of India for its nuts." It does not seem, however, to be in any way cultivated in Ceylon, though the "nuts" are commonly collected and eaten by the

Natives. The "nut" consists of the hard two-horned fruit, resembling a miniature bull's head, and is of a dark brown or sometimes black colour. The interior is said to be agreeable to eat when fried.

Triphasia aurantiola (Rutaceæ). Chinese Lime.—A small spiny shrub, native of South China, but said to be naturalised in India. It is recommended in the West Indies as a stock for

VOA-VANGA.—*Vangueria edulis.*

budding oranges and limes upon. The small red, berry-like fruit can hardly be considered edible, though in China it is made into a preserve, the whole berry being used. It is also prepared in Manila in a similar manner and exported as "Lime-berries." Thrives at medium elevations, probably not grown in Ceylon outside Peradeniya Gardens. Propagated by seed.

Vangueria edulis (Rubiaceæ). Voa-vanga.—A small shrubby, deciduous tree, native of Madagascar, producing a large number

of smooth, round, green fruit, of the size of a small apple. This when ripe acquires a yellowish green tint, the sweetish acid juicy pulp suggesting the flavour of the "Velvet Tamarind" (*Dialium*). The tree thrives and fruits at Peradeniya, and would appear to give promise of improvement by cultivation and selection. The coolies here display a keen partiality for the fruit when approaching ripeness. The large, shining, light-green leaves are said to be used in medicine in Madagascar. Suited to the moist low-country up to 2,000 ft. Propagated by seed or cuttings (*See illustration*).

Vitis vinifera (Ampelidæ). Grapes, or Grape-vine. The Grape-vine is extensively cultivated in Southern Europe (its native home), Australia, South Africa, and Southern United States; also in England and elsewhere in glass-houses (vineries), the finest dessert grapes being produced under the latter conditions. In the dry provinces of India, grapes of very fair quality are grown, both from exotic and indigenous sorts, while in the dry northern part of Ceylon certain varieties of grape have long been cultivated with some degree of success. Here the want of a winter's rest, which is so essential to the plant, is partially supplied by periodically baring the roots and exposing them to the sun. This operation is resorted to once a year, about the time of the principal pruning, in July. A practical experiment which was made a few years ago at Colombo, under the supervision of an expert viticulturist, proved conclusively the unsuitability of the uniformly steamy and hot climate here to the grape vine. Exhaustive efforts have also been made by Mr. W. Nock at Hakgala Gardens, Ceylon (elevation about 5,000 ft.) in growing vines in a glass-house, which, however, ended in failure as regards the production of fruit. The essential conditions for the grape-vine are: a dry warm temperature when the fruit is setting and ripening, and a cold period for resting or "wintering." A wet climate is unsuitable, but moisture at the roots is essential, and this is best supplied by irrigation, which may be continued until the branches are commencing to ripen, when it should cease. In vineyards, the vines are usually planted in rows and grown on the bush system, being pruned back each year to a height of about four feet. In glass-houses and in the tropics they are, however, best grown as climbers, being provided with supports by means of horizontal wires or trellises, pillars, etc. In Jaffna, the vines are usually trained over a pandal or trellis.

Propagation. The Grape-vine is readily propagated by cuttings, which should be inserted slanting-wise in the soil, with only about two buds above the surface, and the earth well pressed upon them.

Pruning and Thinning. The usual pruning is carried out after the crop is over, all lateral shoots being pruned back once a year to within two or three buds of the main stem, and any unnecessary growth removed. In order to obtain fruit of the best quality, the berries should be thinned out by means of a pair of fine scissors and the bunches also reduced in number.

Manuring. The plant requires liberal treatment. A mixture of loamy soil and decomposed cattle manure suits it well. In Jaffna, fish manure is considered the best fertiliser, though the Natives have also a strong belief in the value of salt as a manure for vines. As stimulants, artificial manures give excellent results.

Varieties. All the numerous varieties of the Grape-vine cultivated are considered to belong to *Vitis vinifera.* There are, however, numerous species of *Vitis*, many of them indigenous to Ceylon; but none of the latter can be considered to produce edible fruit, except perhaps *V. indica.* The *Black Hambro*, with dark purplish fruit and *Muscat of Alexandria*, with pale-green berries, are grown in the northern part of Ceylon. In addition to these the following varieties are said to give good results in Jamaica, viz; *Barbarossa, Muscat Hamburg*, and *Gross Colman.*

Yield. In Jaffna, Ceylon, two crops a year are obtained, the principal one in March, and the second in September. The fruit takes three to four months to ripen, from the time of flowering, the vines (which grow to a large size) each producing an annual crop of from 100 to 300 lb. or more; this is sold at prices varying from 30 to 50 cents (=6*d.* to 8*d.*) per lb.

Zizyphus jujuba (Rhamnaceæ). Jujube; "Masan" *S.*; "Ilantai" *T.*—A small, thorny, spreading tree, native of Ceylon, India, and Malaya. The fruit, which is borne in great profusion and is in season about October, is of the size of a large cherry, smooth and shiny, yellowish in colour, with a kernel in the centre; it is rather acid in flavour, and in India is said to "afford a very nice dish when cooked with sugar." In Ceylon, however, the fruit is usually eaten only by children. The tree thrives up to about 3,000 ft., and is propagated by seed.

Z.—vulgaris.—A small thorny tree, native of Syria and Levant, said to be "commonly grown about Calcutta and in most parts of India." The round fruit has a thin, pale-green smooth rind; the fleshy substance between the kernel and the rind is of a pleasant flavour, crisp and refreshing, not unlike a juicy apple, but it has little to recommend it as a fruit. Propagated by seed. Suited to low elevations only.

CHAPTER XI.

SUB-TROPICAL OR TEMPERATE FRUITS

Suited to High or Intermediate Elevations, with Rainfall from 60 to 80 inches or more

[S=Sinhalese ; T=Tamil]

Aberia caffra (Bixaceæ). Kei Apple.—A small thorny tree or tall shrub, native of the Cape and Natal. The fruit is of the form of a small apple and, when ripe, is made into a preserve ; in an unripe state it is used as a pickle. The tree has been established at Hakgala Gardens, Ceylon, since about 1880, but has only been known to fruit once.

Anona Cherimolia (Anonaceæ). Cherimoyer.—A small tree, native of S. America and the West Indies, introduced into Ceylon about 1880. The large, green, round or heart-shaped fruit is 3 to 5 inches in diameter, weighing from 2 to 4 lb., and has a pitted rind ; it somewhat resembles the Custard-apple, and is known in Covent Garden Market, London, under that name. The Cherimoyer has been described as one of the three finest fruits in the world, the other two rivals being the Mangosteen and Pine-apple. Dr. Lindley, however, considered that "one good European Pear is worth all the Cherimoyers of Peru." The tree is now cultivated in many up-country gardens in Ceylon, especially in the Udapussellawa district, where it ripens fruit chiefly between October and December. In Madeira, the tree is systematically cultivated, being propagated by grafting. It may also be raised from seed, but the best varieties have almost seedless fruits. Cherimoyers are regularly imported from the Canary Islands into London, where they are often retailed at 1*s*. to 2*s*. 6*d*. each. The white and somewhat granular pulp is similar to that of the Custard-apple, but much pleasanter to the taste than the latter. The tree is best suited to the hill districts, preferring a rather dry climate ; it is considered to thrive best on deep, rich soil in which lime is present.

Carica candamarcensis (Passifloraceæ). Mountain Papaw.—A small semi-herbaceous tree with a crown of large coarse palmate leaves, native of Colombia and Eucador, similar to the Papaw of the low-country, but with fruit only a fraction the size of the latter. The tree has been introduced at Hakgala Gardens, Ceylon, in 1880, and is now commonly grown in hill gardens for the sake of its fruit, being often found in a semi-naturalised state about up-country bungalows. The ovoid green fruit is characterized by longitudinal ridges, and is in season all the year round; though

CHERIMOYER, OR CHERIMOLIA. *Anona Cherimolia.*

too acid to be used for dessert, it is very agreeable when stewed, and can also be made into jam and preserves. When ripe the fruit has a pleasant apple-like odour. Propagated by seed.

Carya oliviformis (Juglandaceæ). Pecan-, or Pican-nut.—A handsome tree with a straight trunk, reaching a height of about 70 feet, native of Texas, etc. The nuts are considered to be the most delicious of the Walnut kind, and form an important article of commerce in the Southern United States. The export of these nuts from Texas is said to value about £12,000 annually. There are several varieties in cultivation. The tree has not as yet been

established at Hakgala Gardens, nor apparently in Indian hill gardens, with the exception possibly of "one or two varieties under trail" at Saharanpur Botanic Gardens. It requires rather a dry and temperate or sub-tropical climate.

Cassimoroa edulis (Aurantiaceæ, Orange family). Mexican Apple, White Zapote, or Zapote Blanco.—A medium-sized tree of Mexico, characterized by large palmate leaves (divided into 5 leaflets), and greenish flowers borne in racemes. The fruit of the best varieties is edible, being of the size of a medium apple, and

MOUNTAIN PAPAW. *Carica Candamarcensis*

is considered by some to have an agreeable flavour. The seeds, which are comparatively large, are considered poisonous; these as well as the bark and leaves are used medicinally in Mexico. The tree has been introduced to Peradeniya in 1899, but has not yet produced fruit here.

Castanea chinensis (Cupiliferæ). Chinese Chestnut.—This tree, a native of China, yields a superior nut, but has not been found suited to the hill districts of Ceylon, and is reported to have similarly failed in India. The most likely conditions for it

in Ceylon are found in the drier climate of Uva, at 3,000 to 4,000 feet elevation. Plants could be obtained through the Yokohama Nursery Coy., Yokohama, Japan.

C.—vesca. Spanish Chestnut.—A very handsome tree, lately introduced at Hakgala and certain other hill gardens in Ceylon. It is commonly grown on the hills of Northern India, where it produces in March and April its panicles of lavender-coloured blossom, the fruit following in May and June. I am not aware whether it has yet fruited in Ceylon.

Cerasus vulgaris (Rosaceæ). Cherry.—The Cherry tree grows freely at Nuwara Eliya, and flowers abundantly in January and February, but so far as I am aware has never produced fruit in Ceylon. CAMERON says (see FIRMINGER'S *Manual of Gardening in India*) : " Every attempt to cultivate it in the Plains of India has hitherto proved an utter failure. It is, however, grown to perfection on the hills with a little care." There are some species of Cherry indigenous to Northern India which yields fruits suitable for making tarts. Propagated by budding, cuttings, or layers.

Ceratonia siliqua (Leguminosæ). Carobs, or Carob-bean ; Locust-bean ; St. John's Bread.—A small shrubby tree, native of South Europe, and extensively cultivated in the Mediterranean region for its sweet, sugary, flat pods ; the latter are about 6 inches long, nearly 1 inch wide, dark brown in colour, and form a considerable article of export in the countries named ; they are a valuable fattening and nutritious food for cattle, and are also eaten and relished by human beings. The tree is a slow grower, but is of great longevity, being considered to remain productive for over a hundred years, and may live for several years more. When in its prime, between 18 and 40 years old, it produces several hundredweight of pods in a season. Efforts have been made to establish the tree in Ceylon ; but, although specimens have for several years been growing at Anuradhapura, Hakgala Gardens, Albion Estate, etc., none have as yet borne fruit worth speaking of. The Carob-bean tree is frequently unisexual, so that trees raised from seed are often unproductive. The usual method of propagation is by cuttings.

Citrus Aurantium (Rutaceæ). Orange.—(See under *Tropical Fruits*).

C.—Limonum. Lemon ; " Natran " *S.* ; " Kidanar-attankai " *T.*—This small-sized tree, native of Northern India, is extensively

cultivated in Southern Europe and elsewhere for its well-known fruit, which is usually oval in shape, and pale-yellow when ripe. The tree grows freely at medium and high elevations in Ceylon, but the fruit produced here is invaribly coarse and pithy, with a thick warty rind, and can seldom compare with the lemons of temperate countries. The variety "Lisbon Lemon," imported as grafted plants from Australia, has for a time grown and fruited well in some up-country gardens ; but after a few years it becomes unproductive. Lemon fruits are very largely used for flavouring in confectionery, etc. The rind yields a valuable essential oil and citric acid ; for making candied lemon peel, it is also largely used. The Lemon and Orange require similar conditions of climate and soil. (See Oranges under *Tropical Fruits*). Propagation of the Lemon should be by budding, but plants are easily raised from seed (pips), or by layering.

C.—medica Citron ; "Cidran" *S.*—A small tree, much cultivated in Southern Europe and the Mediterranean region for its fruit. The latter grows to a large size, sometimes 10 to 12 (but usually only about 4 to 6) inches in diameter, being round or oval in shape. The thick rind is the part used, this being prepared in brine, preserved in sugar, and largely employed in confectionery, preserves, marmalade, etc. The fruit varies in size and shape according to varieties. The "Fingered Citron" resembles a man's hand, with the fingers bent up as with cramp. Citrons are not commonly cultivated in Ceylon, though good fruits may occasionally be met with in hill gardens. The leaves of Citron are distinguished from those of other species of Citrus by not having the petiole winged. Propagated by seed, budding, or layering.

Cyphomandra betacea (Solanaceæ). Tree Tomato ; "Vegetable Mercury" "Gas-Takkali" *S.*—An ever-green, semi-woody shrub, native of Peru and introduced into Ceylon through Hakgala Gardens, in 1882. It has become thoroughly established in many hill gardens, and is commonly grown about Nuwara Eliya for market. The egg-shaped and smooth-skinned fruit, produced in great abundance and in hanging clusters at the ends of the branches, is in season almost throughout the year, but chiefly from March to May. At first greenish purple, it changes in ripening to reddish yellow. Some varieties are of a deep purple colour when ripe. The sub-acid succulent fruits are refreshing and agreeable when eaten raw, but their chief use is for stewing ; they may also be made into jam or preserve. The tree is a quick grower, and

commences to bear fruit when about two years old, remaining productive for several years. Thrives best on deep soil, and is propagated by seed (*See illustration*).

Diospyros Kaki (Ebenaceæ). Persimmon ; Date-plum.—A medium-sized, slow-growing tree with large handsome, ovate or

TREE TOMATO. *Cyphomandra betacea*

cordate leaves, native of China and Japan. The attractive, shining smooth fruit is usually of a bright orange-yellow when ripe, sometimes pink or dark-purple. It is globular or pear-shaped, usually about 3 inches in diameter, though sometimes more. Each fruit

usually contains two almond-like seeds in the centre, but some varieties are seedless. When perfectly ripe, or even in a bletted condition, it has an agreeable flavour, being compared to an apricot with a suspicion of the medlar, or to an over-ripe apple. In a less ripened state it is, in its native country, made into a well-known preserve. Dried Kaki fruit is said to be equal to dried figs. The tree thrives in the Riviera, whence excellent fruit are imported into London, and sold in Covent Garden market at fancy prices. It is also said to thrive and bear abundantly at Calcutta, Saharanpur, etc., but has not as yet become well-known in Ceylon. It was introduced at Hakgala Gardens in 1888, and occasionally produces fruit there. The Persimmon is usually diœcious, so that it is necessary to have a male tree in the neighbourhood of a pistillate tree to ensure the fertilisation of the flowers of the latter.

FEIJOA, OR "PINE-APPLE GUAVA." *Feijoa Sellowiana*

Feijoa Sellowiana (Myrtaceæ). Feijoa-fruit, or "Pine-apple Guava."—A small bushy tree, 6 to 8 ft. high, native of South America, and recently introduced into cultivation. It is closely allied to the common Guava, and much resembles that plant in the character of its fruit. In California it is considered a valuable addition to the fruits of that country, the flavour being described as "delicious, and not unlike that of the strawberry." The fruit is oval in shape, 2 to 3 inches in length, highly perfumed, and is in season in November. "It can be used either raw, stewed, crystallized, or made into jam or jelly." The seeds, by which the tree may be propagated, are very small.

Ficus Carica (Urticaceæ): Fig.—A small spreading, deciduous tree or large shrub, native of Turkey and the Mediterranean region, where it is extensively grown for its fruit. Fig trees grow moderately well and set fruit freely in hill gardens in Ceylon, but owing to the South-west monsoon rains setting in when the trees are in bearing, the fruit seldom ripens well ; in fine weather a few fruits occasionally ripen, but these are wanting in flavour. FIRMINGER said : "In most parts of India, Fig trees are to be met with thriving vigorously and bearing fruit abundantly," but presumably this refers to the plains, for CAMERON says he has "not seen the Fig tree under cultivation in the hills in India." The Fig thrives in dry, arid places, requiring no shade and but little moisture, the essential conditions being good drainage, a rich porous soil, and a dry hot season for ripening the fruit. Thus in the drier parts of Uva, in Ceylon, Fig trees have been found to ripen fairly good crops. The trees should be sheltered from strong winds, and usually thrive best in an enclosed yard, with their roots confined to a limited space. In Greece, the average yield of a Fig orchard is said to be about 1,600 lb. of fruit per acre. The "Smyrna Fig" is the best kind, but there are numerous other varieties in cultivation, as Golden-Fig, Purple-fig, White Adriatic, Black Ischia, etc. The two last named have been found the most approaching to success at Nuwara Eliya, according to Mr. COTTON. The Fig is easily propagated by cuttings, which travel well by post. The fertilisation of the minute flowers, which are enclosed in the hollow of the fruit, is dependent on an insect, the process being known as *caprification*.

Fragaria vesca (Rosaceæ). Strawberry.—A low herbaceous creeping perennial, producing "runners," by which the plant is readily increased. A species of Wild Strawberry (*F. nilgerrensis*) is indigenous to the hills of South India. Wild Strawberries are to be found occasionally in patches up-country, especially about Hakgala and Nuwara Eliya ; DR. TRIMEN considered that these were escapes from cultivation. Improved cultivated varieties have been introduced into Ceylon from time to time, which, in the dry season in up-country gardens, produce and ripen fruit of very fair quality, though somewhat lacking in flavour. The plants should be planted in rows about 18 inches apart, with 12 inches between the plants in the rows. The soil must be well-drained, rich and porous. Of the varieties tried at Hakgala Gardens, "Crescent Seedling" has so far afforded about the best results.

Juglans regia (Juglandaceæ). Walnut.—The Walnut tree is commonly cultivated on the hills of Northern India, where it produces abundant crops. It is not, however, a success on the plains, nor on the hills of Southern India. It has been tried at Nuwara Eliya and Hakgala Gardens, Ceylon, but so far without success.

Morus indica (Urticaceæ). Indian Mulberry.—A small quick-growing tree, native of Northern India, where it is commonly cultivated. The fruit resembles a small pepper-corn, cylindrical in shape, rather deficient in flavour, and quite inferior to the European mulberry. There are two sorts, the "white" and the "black," both being similar in taste. FIRMINGER said : "the fruit, such as it is, ripens in February in Bengal, but it is fit for little but to be left to the birds." The Indian mulberry is now commonly grown in Ceylon at low and medium elevations, especially at School gardens, where its cultivation has been encouraged for the purpose of affording food by means of its leaves to the mulberry silk-worm. Easily propagated by cuttings.

M. nigra. European mulberry.—This is a native of Persia, and has been introduced and established at Hakgala and some other up-country gardens. I am informed that it bears plentifully in the Haputale district (about 5,000 ft. alt.) in Ceylon, where the fruits are used for making tarts.

Olea Europea (Oleaceæ). Olive.—A small tree, native of North-western Asia, and naturalised in the Mediterranean region. It is extensively cultivated in Northern Africa, Southern Europe, California, etc., both for its fruit, which is so largely used in preserves and pickles, as well as for the extraction of the valuable olive oil. Plants have been introduced into Ceylon, and grown for many years without producing fruit worth speaking of, though an odd fruit may be produced occasionally without being noticed. MR. JAMES RYAN, of Talawakelle, picked a fruit from an olive tree in his garden in 1908. Olives have not been found suited to the hills in S. India, and even in the dry climate of Bangalore, trees 30 years old have remained unproductive. Olive cultivation has of late been introduced into Australia and South Africa, with prospects of success. In California, where it is now successfully established, the crop is said to yield an average of 600 gallons of olive oil per acre, the maximum return being as high as 2,000 gallons per acre. The tree is susceptible to either a very hot or very cold climate, and thrives best in light soil of a limestone

formation. There are numerous varieties in cultivation, differing in the lateness or earliness of the crop, and in the shape and size of the fruit; the latter varies from round to ovate or oval, and from ¾ to 1 inch in diameter. Propagated from seed, cuttings, layers, or suckers.

PASSION FRUIT. *Passiflora edulis.* As Grown at Nuwara-Eliya, Ceylon.

Passiflora edulis (Passifloraceæ). Passion-fruit, or Sweet-cup.—A perennial climber, native of Southern Brazil, introduced into Ceylon and commonly cultivated up-country for its fruit. As an escape from cultivation it may now often be met with

in a wild state at elevations of 3,000 to 5,000 feet. It bears in great abundance a perfectly smooth oval fruit, of the size of a hen's egg, purple when ripe. Two crops a year are sometimes produced, the principal season being from May to July. The fruit contains in its hollow centre a quantity of fragrant sweet juicy pulp, inseparable from which are the small seeds; this when emptied out of the shell, and beaten up in a glass with a pinch of bicarbonate of soda and sugar, forms a delicious drink. The fruit is sold locally at about Re. 1 (1*s.* 4*d.*) per

CAPE GOOSEBERRY. *Physalis Peruviana.*

hundred. Consignments of the fruit are occasionally exported from Australia and elsewhere to London, and these usually secure fancy prices, but the shrivelled appearance which the fruit assumes on ripening is against it for market purposes. The Passion-fruit may be cultivated successfully from 2,000 ft. upwards, and may either be allowed to grow over a fence or trellis-work, or climb over trees, etc. Rich humous soil and a moist shaded situation suit it best. Propagated by seed. (*See illustration*).

Persica vulgaris. Peach. (See under *Prunus*).

Phyllanthus Emblica (Euphorbiaceæ). "Nelli" *S.*—A small tree or shrub, with graceful feathery foliage, native of Ceylon,

India, Malaya, China, etc. It is commonly found wild in open patna land in Ceylon, up to 4,000 ft., being also sometimes grown in gardens for ornament. The round green fruits, of the size of marbles, with a comparatively large kernel, are made into a much-esteemed preserve (See under *Useful Recipes*). The fruit is collected from plants in the wild state when in season, chiefly from November to February, and sold at from 3 to 6 cts. per hundred. Propagated from seed. Suited to intermediate elevations.

Physalis Peruviana (Solanaceæ). Cape Gooseberry; Peruvian Cherry.—A low, straggling or creeping herbaceous perennial, native of Peru, naturalised at the Cape and to some extent in the hill districts of Ceylon. The fruit is of the size and form of a small cherry, and is concealed in the dry, leafy, persistent calyx. When quite ripe it is yellow and of an agreeable and refreshing flavour, being used for dessert or for making jam or preserves. In South Africa it is largely made into jam, which forms an article of export there. The plant is easily raised from seed, and will thrive in any ordinarily good soil, but is most productive on rich sandy soil. Sow in sheltered beds, and plant out seedlings about 18 inches from each other in rows 3 feet apart. Suited to elevations of 3,500 to 5,000 feet or higher. (*See illustration*).

Pistacia vera (Anacardiaceæ). Pistachio-nut.—A small tree, reaching about 30 feet in height, considered to be indigenous to Syria. It is extensively cultivated in Northern India, Florida, etc., for its delicious nut, which is eaten as a dessert or prepared and used in various ways. During the cold weather in India these nuts, being brought from Cabul by Afghan traders, are said to be obtainable in great abundance in the bazaars, so that "travellers often take them to be a product of the country." In the Ceylon boutiques, however, the nuts appear to be an unknown commodity. The tree might thrive to some extent at moderate elevations in the drier parts of the Uva Province of Ceylon.

Prunus Armeniaca (Rosaceæ). Apricot.—The cultivation of this delicious fruit in Ceylon has so far been nowhere successful, nor does it seem to have been attended with much better results in India. In the latter country, however, the tree is said to grow with vigour on the hills, where it is sometimes propagated by budding or grafting, which is done in April or May.

P.—domestica. Plum.—A small deciduous tree, whose native country is uncertain. In Ceylon, as in other parts of the Torrid Zone, the plum has not so far proved quite amenable to cultivation. Certain varieties have been found to produce fairly heavy crops about Nuwara Eliya, but the fruit seldom ripens, as the monsoon rains usually commence when it is approaching maturity. In India, however, on the hills and in the Northern Provinces, plums are said to be grown with a greater measure of success, the methods of cultivation there being much the same as those adopted for the Peach. The fruits produced, however, are "hardly palatable, except when cooked or preserved;" for the latter purpose they are said to be excellent. CAMERON says: "Of many kinds tried at Bangalore, 'Kirk's Blue,' 'Greengage,' and 'Golden Drop' were the best." At Nuwara Eliya, MR. COTTON found "Red-heart" (a cooking variety), "Alucha," and "Greengage" to give the best results, while MR. KELLOW also considers the "Hedge-plum" a fairly satisfactory variety.

P.—Bokharensis. Bokhara Plum.—A species of Plum indigenous to Northern India. According to FIRMINGER, "quantities of the fruit in a dried state are annually brought down from Cabul. The tree grows vigorously in the Upper Provinces, and is very common in Gardens in the Punjab, where it bears abundantly." CAMERON adds that it is also successfully cultivated on the hills in India, the fruit being made into a good preserve, or stewed.

P. Persica (= Persica vulgaris). Peach.—A small slender tree, supposed to be a native of China. At its best the Peach in the tropics is very different to the luscious, melting fruit it is in Europe and other temperate countries. Acclimatised varieties are, however, grown with appreciable success in certain localities at elevations of 4,000 to 5,000 feet. In a rather dry climate, as in the district of Wilson Bungalow in Ceylon, moderately good fruits, at any rate for stewing and making jam, are obtained. Here peaches are regularly grown for market, the fruit being retailed at about Re. 1 per hundred. No systematic cultivation, however, is followed, the trees being propagated by cuttings, with but little regard for selection, manuring, etc. Peaches will not thrive at low elevations in Ceylon. At Bangalore, in South India, MR. CAMERON mentions an excellent variety called "Indore." The same authority also states: "It is a great point in the cultivation of the Peach tree to keep the roots

as little below the surface of the soil as possible. This is sometimes effected by placing tiles underneath where the trees are planted." The tree may be propagated by sowing the stones (kernels) of the fruit, but preferably by cuttings, budding, or grafting. Seedling plants take three or four years to come into bearing. A good plan is to sow the seed, and bud or graft the best sorts on the seedlings when about a year old.

Psidium Cattleyanum (Myrtaceæ). China-guava; Purple-guava; Calcutta-guava.—A small shrubby ornamental tree, 20 to 25 feet high, with smooth, grey bark and small leathery, shining, obovate leaves, native of Tropical America. The date of its introduction into Ceylon is not recorded, but that of its first discovery is given as 1818. It has been grown at Peradeniya and Hakgala Gardens for upwards of thirty or forty years, and is now sometimes met with in up-country gardens. CAMERON does not mention it for South India, which is remarkable considering its excellent qualities as a fruit-tree. The fruit is undoubtedly the most palatable of all Guavas, and deserves to be more widely known. It is of the size of a large Greengage, deep claret-coloured when ripe, with soft juicy, purplish red pulp, which has an agreeable flavour and has some resemblance to that of a strawberry. It is excellent for making tarts, jam and jelly, and may also be eaten as dessert. The tree thrives and bears fruit freely at elevations of 2,000 to 4,000 feet, producing two crops a year. With good cultivation, the size and quality of the fruit is considerably improved. Usually propagated by seed, but the best trees should be increased by layering or budding.

Pyrus communis (Rosaceæ). Pear.—Certain varieties of Pear grow and bear well in many parts of the tropics, at moderate elevations and on the hills, but the fruit produced is usually very hard and unfit to be eaten uncooked. In some hill gardens in Ceylon, a variety of cooking Pear has become well established, thriving with but scanty attention, and producing fairly heavy crops of large, coarse fruits, which can only be eaten when stewed. CAMERON states that: "In Simla and other hill stations in India, the Pear can be brought to great perfection under cultivation," and advises pruning the trees in February, just before they burst into leaf. In Ceylon, the trees are practically ever-green. Easily propagated by cuttings, layering, or grafting.

P.—Malus. Apple.—The cultivation of the Apple in Ceylon, even at the highest elevations, has not so far met with success. On the hills in India, however, according to CAMERON, "apples can be cultivated to perfection." At Bangalore a number of varieties are generally grown, including such as *Ribston Pippin, Worcester Permain, Peasgood's Nonsuch, Kentish Fillbasket, Cox's Orange Pippin, etc.* Of the varieties tried at Hakgala Gardens and Nuwara Eliya, *Kentish Fillbasket* was found the most approaching to success. The climate, however, seems entirely unsuited to the tree. In India, apple trees are propagated by cuttings, layering, or grafting, and a rich sandy soil is considered to suit them best. They flower in February and March, and the fruit ripens in April and May. In January the roots are laid bare, and, after an interval of a fortnight, are again covered up with a mixture of cow-manure and good soil. Copious watering is given when the fruit is swelling.

Rhodomyrtus tomentosus (Myrtaceæ). "Hill-gooseberry;" "Hill-guava."—A handsome shrub with small thick oval leaves, indigenous to the mountain region of Ceylon, South India, and Malaya. It produces a profusion of pale pink flowers, followed by small round berries of pale yellow colour; from these a jelly is made, which in flavour somewhat resembles apple-jelly. Propagated from seed. Not suited to low elevations, but an acclimatised variety thrives at Peradeniya (1,500 ft.), where as an ornamental shrub it is much admired; this does not, however, bear fruit here.

Ribes grossularia (Saxifrageæ). Gooseberry.—Plants of this have been imported both from England and Australia, and planted under the most favourable conditions in the Experiment Garden at Nuwara Eliya, as well as at Hakgala Gardens. They grew for a time, but failed in each case to become properly established. The climate in India has apparently been found equally unsuitable for the plant.

R.—nigrum. Black Currant.—The same remarks as above, under Gooseberry, may be applied.

Rubus lasiocarpa (Rocaceæ). Ceylon, or Wild-Raspberry.—A large, straggling bramble, remarkable for the white down with which the stems are entirely covered, indigenous to the hills of Ceylon, India and Java. The fruit much resembles the English Blackberry, and is, when well-grown, equal to it in flavour; its hoary wooly appearance is, however, against it.

In India it is frequently collected and made into delicious tarts, being also in great demand at Simla and other hill stations for making jam. In cultivation, the plant responds well to similar treatment as that usually given to the Raspberry and Bramble. A good rich soil should be afforded, and the old and barren shoots cut out. Propagated by suckers dug out during the rains.

R.—rosaefolius. "Mauritius Raspberry."—A shrub considered to have been introduced from Mauritius, and said to be commonly grown in gardens about Calcutta. The fruit, produced in February, is similar in appearance to the English Raspberry, but filled with hard seeds, and, according to FIRMINGER, having no better flavour than a bad blackberry. SIR JOSEPH HOOKER gives this as an indigenous species in India.

R.—Idaeus. English Raspberry.—This has been tried at Hakgala and Nuwara Eliya Experiment Gardens, but found quite unsuited to the climate. The same remarks as under Gooseberry may be applied.

R.—trivialis. American Dewberry.—I am not aware that this has been tried in Ceylon; it has been reported to grow vigorously and bear fruit well at Saharanpur in India.

Sechium edule. Cho-cho.—See under *Sub-tropical Vegetables.*

Vaccinium meridionale (Vacciniaceæ, Cranberry order).—The fruit is of the size of a Black-currant and is used in Jamaica for making tarts, jam and jelly, according to MR. W. HARRIS. Other species yield edible fruits, as the "Cowberry" (*V. Vitis-idaea*), and Whortleberry (*V. myrtillus*). The Cranberry is produced by *Oxycoccus palustris* and *O. macrocarpus*, the latter being a Canadian species.

Vitis Vinifera. Grape Vine. See *Tropical Fruits.*

CHAPTER XII.

TROPICAL VEGETABLES AND FOOD PRODUCTS

SUITABLE FOR THE LOW-COUNTRY, FROM SEA-LEVEL TO ABOUT 3,000 FT., WITH ANNUAL RAINFALL NOT LESS THAN 35 INCHES

[*S*=SINHALESE; *T*=TAMIL]

Vegetables of one kind or another can, with some trouble, be grown in all parts of the tropics where any other cultivation is possible. While certain European vegetables, as Beet-root, Celery, Parsnips, Cabbages, Globe-artichokes, etc., thrive to perfection in the cool moist climate at the higher elevations, many of these may also be grown at lower altitudes or even at sea-level, with some degree of success, if sown at suitable seasons and supplied with the proper amount of moisture and shade. Tropical vegetables are, of course, suited chiefly to low or intermediate elevations, and many of these are well worth cultivating.

A deep alluvial soil, such as is found near river banks, is the best for vegetables generally. Where this does not exist, a condition approaching it may usually be obtained by the application of sand, humus and organic manure. A loose sandy soil is essential for deep-rooting vegetables, as carrots, parsnips, etc. Frequent stirring of the soil, weeding, watering when necessary, and earthing up of crops are indispensable to the successful cultivation of vegetables generally. In the low-country, light shade, especially for European kinds, is usually beneficial if not indispensable. An application of suitable fertilisers (see *Manures*) usually amply pays for itself by resulting in larger yields, as well as in better quality of crop.

Owing to the multiplicity of vernacular names, and in order to facilitate reference, the chapter devoted to *Tropical or Low-country Vegetables* is divided into four sections, thus:—

(1) Leguminosæ (Beans, Grams, and Pulses).
(2) Cucurbitaceæ (Gourds, Pumpkins, Squashes, and Melons).
(3) Root or tuberous Vegetables and Food crops.
(4) Miscellaneous Vegetables and Food crops.

SECTION 1:—LEGUMINOSÆ

INCLUDING BEANS, GRAMS AND PULSES

Cajanus indicus. Pigeon Pea; Congo Bean; Dhal or Dhol; "Rata-tora" *S.*; "Thovaroy" or "Paripu" *T.*—A shrub 5 to 6 feet high, characterized by thin straight branches and small trifoliate leaves, native of India. It is commonly cultivated in most tropical countries, but more especially in India, where the dark grey seeds, of the size of small peas, are almost a universal article of food. The dried split peas are largely imported into Ceylon, and much used in curries, vegetable soups, etc., being everywhere sold in the bazaars as "Paripu." The plant resists drought well, and is recommended as a restorative crop in rotations. In India, it is grown either mixed with other crops, or planted alone in rows 4 to 5 feet apart. About 8 lb. of seed is required to plant an acre, and the crop is ready for harvesting in six months from the time of sowing. Grown alone, the yield may be as high as 2,000 lb. per acre, 500 lb. per acre being an ordinary return. Not commonly cultivated in Ceylon.

Canavalia gladiata. Sword Bean; "Awara" *S.*; "Awara-kai" *T.*—A robust woody perennial, climbing bean, bearing large, flat, sword-shaped pods, fully 9 inches long and about 1¼ in. wide. These when young and tender are sliced and boiled as a vegetable, being also used in pickles. According to FIRMINGER, "it is considered by some Europeans the nicest of native vegetables in India." The plant requires strong and durable supports, such as a fence or a low spreading tree. Propagated by seeds.

Cicer arietinum. Chick Pea; Bengal-gram; "Konda-kadala" *S.*—An annual, about 1 ft. high, much cultivated in India as a food crop. The small pea-like angular seeds are largely imported into Ceylon and sold in the bazaars, being used either fried, or boiled in curries, and are considered very nutritious. Roasted and ground, they are sometimes used as a substitute for coffee. Sow in drills about 2 feet apart.

Cyamopsis psoralioides. Guar, or Cluster Bean; "Kota-ranga" *S.* or *T.*—A small bushy plant, recently introduced from India into Ceylon, and now becoming commonly cultivated in the low-country here chiefly through the medium of the School Gardens. The small, straight, hairy pods (about 3 inches long, and produced in clusters), are very popular as a vegetable in curries and other preparations, both the tender pods and ripe seed being

used. The plant is cultivated in India for fodder, as well as for green-manuring, and occurs in several varieties, these being distinguished by white, black, and grey seeds.

Dolichos bracteata. "El-dhambala" *S.*—A climbing bean, bearing purplish flowers and narrow, well-filled pods, about 3 inches long. The tender pods are boiled and eaten.

Dolichos Lablab, var. "Ho-dhambala" or "Irivija" *S.*—A strong-growing climbing bean with purple flowers, and flat broad pods with warted margins; the pods are 3 to 4 inches long, and when young and tender are boiled and eaten; the matured seeds are not considered edible. The plant is often seen cultivated at cooly lines in the low-country of Ceylon. There are several varieties of this bean, the following being given by DR. ROXBURGH for India:—

a. "albiflorum": Flowers white, rather small; seeds not eaten.
b. "rubiflorum": Flowers red.
c. "purpurescens": Flowers large, purplish; seeds white.
d. "purpureum": Stems and the large flowers purple; pods deep purple.

"Sudu-dhambala" of Ceylon, with white flowers and short, broad, 2-3 seeded pods, is probably the same as var. *a.* This is grown chiefly about cooly lines and Natives' houses, and the seeds as well as the pods are eaten.

Dolichos biflorus. Madras gram; Horse gram; "Kollu" *S* and *T.*—A semi-erect annual, 2 to 3 ft. high, with small trifoliate leaves, bearing small curved pods 2 to 3 in. long. It is grown somewhat extensively in India, both as a fodder and food crop, and also as a green manure crop for ploughing into the soil. It is specially suited to dry regions, and is said to have produced from 2,000 to 3,000 lb. of green plant per acre in about 12 weeks, during which the rain did not amount to 1 in. The plant is also commonly grown in Ceylon in the dry low-country districts.

Glycine hispida. Soya Bean.—An erect annual, varying in height according to variety and soil, usually from about $1\frac{1}{2}$ to 2 ft., though sometimes reaching 3 or 4 feet or more. It is a native of China and Japan, where it has been cultivated for food from time immemorial. The short hairy pods contain 2 to 4 seeds each; the latter are a nutritious food and a standard diet with the Chinese and Japanese. The pea-like smooth seeds (generally referred to as beans) vary from white to yellow and black. They are cooked and prepared for food in numerous ways, being either boiled, roasted, or ground into flour. They contain little or no starch, and are consequently used as a diet for diabetic patients. In America

and on the Continent, they are sometimes used as a substitute for, or adulterating, coffee. In India they are eaten in the form of "dhal." The famous Soya-sauce, said to be the basis of many popular sauces made in Europe, is made from these seeds. A useful domestic oil is also obtained from them, and the residual cake resulting from the expression of the oil forms a nutritious cattle-food. Recently a considerable demand has arisen, chiefly in England, for the seed for the purpose of supplying oil for soap making, etc. The present quotation for the seed in England is about £8 to 9 per ton in London. According to SIR GEORGE WATT, the Soya Bean is extensively cultivated in Eastern Bengal, Khasia Hills, Burma, etc. Yet I can find no mention of it in either FIRMINGER's or WOODROW's works on gardening in India. Cultivation is very simple. A loose rich soil is preferable. Seeds may be sown thinly in rows about 1½ to 2 ft. apart, about 2 bushels of seed being required to sow an acre. The seed should germinate in four to five days, and the crop may be ready for picking in about six weeks to 2 months from the time of sowing. The yield of seed varies, according to soil, etc. 15 to 20 bushels* per acre is considered a good average, while the amount of green fodder produced per acre may be about 6 to 10 tons. The plant has been successfully grown at Peradeniya, and might thrive at elevations up to about 3,000 feet ; but it does not appear to be suited to tropical conditions, and seems especially adapted to the cotton and corn belt, thriving best on fertile loam or clay. It is a valuable soil renovator, and would seem to be adapted for green-manuring on loose sandy soils. There are several varieties, these varying in the colour of the seed ; the yellow-seeded variety is probably the best suited for the tropics.

Ground Nuts. See under *Miscellaneous Vegetables.*

Lens esculenta (= **Ervum lens.**)—Lentil ; "Misurupur" *T.*—This valuable pulse has been cultivated and used as food from time immemorial, and Lentils are to this day an important article of food to the inhabitants of Egypt, Palestine, and the Mediterranean region. As a winter crop, the plant is grown all over India, especially in the Central Provinces and Madras. The land having been ploughed, the seed is sown broadcast, one maund (about 80 lb.) of seed on an average being sown per acre. If sown in drills, half that quantity will suffice. The seed is eaten as "dhal," and considered the most nutritious of pulses. The dry leaves and

* Say 1,600 lb. to 2,000 lb.

fodder are esteemed as a food for cattle, and the plants are a valuable green-manure. Lentils thrive on clay soils, but with irrigation may also be grown on light sandy ground.

Mucuna nivea. (=Sticolobium pachylobium); "Wanduru-mé," *S.* "Lyon Bean" of Philippines—A strong-growing perennial climbing bean, with stout pods about 3 inches long, and black oval seeds. It is suited to low and medium elevations, but is seldom cultivated in Ceylon. Here the seeds only appear to be eaten, but in India the fleshy tender pods, after the removal of the outer skin, are also eaten; these when dressed are, according to the late Dr. Roxburgh, "a most excellent vegetable for the table, the full grown beans being scarely inferior to the large garden-beans of Europe." Sow seeds thinly any time after the commencement of the rains. The plants require strong supports to climb upon.

"Velvet Bean" is a name given to a variety of *Mucuna nivea.* distinguished from the above by having smaller and more numerous black, velvety pods, containing round mottled seeds. This came recently into prominence in the Southern United States as a forage and green-manure plant, the seeds also being eaten to some extent. Suited to low and medium elevations.

Pachyrrhizus tuberosus. Yam Bean.—A strong-growing climbing bean, native of the West Indies, producing a large edible tuberous root, introduced at Peradeniya in 1887. The tuber is cooked and eaten as a yam; the pods, which are about 8 inches long, are also edible when in a tender state. The plant is said to be commonly cultivated in its native country, but is as yet scarcely known in Ceylon. Cultivation same as for yams. Sow seeds thinly in rows 3 to 4 feet apart, and support the vines with stout sticks; otherwise plant against trees or a fence. There are two varieties of this plant, one bearing blue flowers, the other white; the former is considered the better variety to cultivate.

Phaseolus lunatus. Lima Bean; Tonga Bean; "Pothu-dhambala" *S.* "Pithanga" *T.*—The Lima-bean is held in high estimation in America, its original home, but is not much appreciated in Ceylon, nor apparently in India. It is best suited to high elevations, and is sometimes seen in up-country native gardens here. The pods are short, flattish, and rather curved; these are not generally considered edible, but the large flat seeds, which are mottled or white, when boiled are "exceedingly agreeable, having a mealy roast-chestnut-like flavour." The plants are of a robust habit and are distinguished by racemes of small white flowers and rather dense foliage. There are several varieties, some

with white and others with pink flowers; the seeds also vary in colour from white to cream, pink, and purple. Sow in rows 3 to 4 feet apart, with about 6 inches between the seeds in the rows. Place sticks along both sides of the row for supporting the vines.

Phaseolus Mungo (=P. Max); Green Gram; Mung; Mun-eta, *S*; Pasi-pyru, *T*.—A small erect annual, about 16 in. high, with narrow, cylindrical, straight radiating pods, 2½ to 3 in. long (in clusters) and trifoliate leaves, the whole plant being hairy. It is a native of India, and has been cultivated there as a food crop from time immemorial, being still grown extensively in certain provinces and to some extent in the dry zone of Ceylon, either as a single product or as an inter-crop. The green pods are sometimes eaten as a vegetable, but it is the ripe pulse that is valued, this being cooked and used in various forms like dhal. The grain has a pleasant taste, and is regarded as a wholesome and nutritious food. The straw as well as the pulse is valued as a food for cattle and horses. The plant is suited to dry districts and thrives in the plains of India and up to 6,000 ft. elevation. When grown alone, under average conditions, a yield of 5 maunds (400 lb.) of grain per acre may be obtained.

Phaseolus Mungo, var. radiatus; Kalai. This variety, known in India as "Urd," differs from the above (Green gram) in having a longer stem and more trailing habit, also in the plant being more hairy, the seeds fewer, larger and usually dark brown in colour. The ripe pulse, according to SIR GEORGE WATT, is the most highly esteemed of all pulses in India and fetches the highest price. It is eaten in the form of dhal bread, boiled whole, or as spiced balls, and is the chief constituent of the wafer biscuits known in Bombay as "papad." The average amount of seed required to sow an acre is said to be 6 lb., and the average return, when grown as a sole crop, is about 5 maunds or 400 lb.

Phaseolus vulgaris, var.—Climbing, or Runner Beans; Bonchi, *S.* "Bonchi-kai" *T.*—This slender climbing bean is perhaps the most useful of all beans for the low-country and medium elevations. Though less prolific than the dwarf erect kinds, it remains longer productive than the latter, which is of importance when grown only for one's own table. With a few successional sowings it can be had in fruit almost throughout the year. The young tender pods are the parts used, these being usually cut up into thin strips, boiled, and served in different ways. Sow the seeds thinly in rows, in well-tilled and manured soil. The seedlings will be up in

from 4 to 6 days, and when a few inches high they should have the earth drawn up to them. Stakes should then be fixed in the ground along both sides of the rows for support to the vines. Both this and the following bean are among the best vegetables found in the tropics, and may be grown in a variety of climates.

Phaseolus vulgaris, var.—Dwarf, French, or Kidney Bean. —See under *Temperate* or *Sub-tropical Vegetables.*

Psophocarpus tetragonolobus. Winged Bean, Goa Bean, Manila Bean, Princess Bean, "Dara-dhambala" *S.*—A strong-growing climbing bean, native of Malaya, with large pale blue flowers, bearing peculiar four-cornered pods. The latter are 6 to 8 inches long, and have a leafy fringe running along the length of each of their four corners. They are cooked when green, and usually much relished. In Burma the plant is largely cultivated for its fleshy tuberous roots, of which the yield is said to be from 1¼ to 2 tons per acre. When grown for the roots, seeds are not allowed to ripen. Propagated by seeds, which may be sown in drills or where the plants are to remain. There are several varieties in cultivation, these being distinguished by length of pod, breadth of wings, and colour of seeds.

Vigna sinensis.—Cow Pea; Yard-long Bean; "Me-karal," "Diya-mekaral" or "Polon-me" *S.*—An annual climbing bean, bearing long narrow pliant, cordlike pods, which reach from 1½ to about 3 feet in length. These are used like French Beans, and the ripe seeds also are eaten. The plant is suited to low and medium elevations, and thrives in rather poor as well as rich soil. In Australia it is said to bear plentifully in seasons of drought. *Vigna Catiang*, *V. unguiculata*, and *V. sesquipedalis* are considered to be only varieties of *V. sinensis*.

SECTION 2:—CUCURBITACEÆ.

GOURDS, PUMPKINS, SQUASHES AND MELONS.

These comprise a group of climbing plants which yield excellent vegetables and sometimes dessert fruits. The plants are characterised by having *unisexual* flowers (the sexes in separate flowers), being in some cases *diœceous* (the sexes on separate plants). They are of rapid growth, and therefore require rich soil and abundant water at the root. As a rule, they yield larger and better fruits in a rather dry climate, under irrigation. Propagation is usually by seed, but in many cases it may be effected also by cuttings.

Benincasa cerifera.—Ash Pumpkin, or White Gourd; "Alupuhul" *S*; Puchini" or "Pusanikai" *T.*—A large handsome oval-shaped gourd, grown throughout the Eastern tropics, China, Japan, etc. The fruit is covered with a whitish waxen bloom (hence its popular names), and is used as a vegetable in curries, etc., also candied as a sweetmeat. The plant is an annual, with large angular leaves, and may often be seen growing over the roofs of Natives' houses. In India the fruit is said not to be so liable to be stolen as those of other gourds, owing to certain religious superstitions connected with it. Seed may be sown in the rainy season, and the vegetable should be fit for use about three months later. The plant will thrive in sheltered valleys up to about 3,000 or 4,000 feet.

Citrullus vulgaris. Water-melon; "Komadu" *S.* (See under *Tropical Fruits.*)

Cucumis Melo. Melon; "Rata-komadu" or "Kekiri" *S.* (See under *Tropical Fruits.*)

Cucumis sativus, var. Native Cucumber; "Pipingha" *S.*; "Pipingkai" *T.*—A thick cylindrical, smooth fruit, 10 to 15 inches long and about 3 to 4 inches in transverse diameter, usually with a brownish yellow thin skin when full-grown. The flowers are yellow, about 2 inches across. The fruit is either cooked and used as a vegetable or, peeled and sliced, in salads, being an excellent substitute for the English Cucumber, of which it is considered to be but a form. It is cultivated chiefly in the semi-dry districts for supplying the local markets and boutiques. Sow seed in ridges or mounds of rich soil. The vines may either be supported on trellis-work, or allowed to trail over the ground.

Cucumis sativus, var. "Tee-ambara" *S.*—A variety similar to Pipingha, but with smaller fruits, these varying in length from 6 to 8 inches, with a transverse diameter of about 2 inches. Flowers yellow, about 1 inch across. The fruit of this variety, being of a tougher texture than the preceding one, is only used in curries, not in salads.

Cucurbita maxima. Pumpkin; "Wataka" or "Rata-labu" *S.*—A large globular, bluntly-ribbed, brownish gourd, very commonly cultivated by the Natives in the low-country of Ceylon, especially in the rather dry districts of Kurunegala, Dumbara, etc. It is everywhere sold in the markets and boutiques, either whole or in sections, and though rather insipid is one of the best of "native" vegetables. During the detention of the Boer prisoners

of war in Ceylon a great demand for Pumpkins sprang up, and the cultivation of the vegetable proved very profitable for the time being. Seeds may be sown at any time during the rains. The plant is an annual, and may be allowed to run over the ground without supports. The fruits sometimes grow to an enormous size, instances being recorded of specimens having attained a weight of 300 to 400 lb. The hardened shells are sometimes made into vessels and ornaments. There are several varieties, which vary more or less in form and colour of the fruit.

Cucurbita Melo-pepo. Squash.—The name squash is given in America to numerous varieties of gourd which bear variously-shaped fruits, the latter ranging from oval to almost flat or shell-like. Squashes are extensively grown in sub-tropical America, where they are much relished, but are not suited to a wet tropical climate. At Peradeniya, the plants have been found to grow well, but the fruits, such as did set, usually damped off early. In a drier district, however, they might succeed better. It is advisable to sow seeds in pots or pans, and transplant the seedlings, when large enough to handle, into mounds of well-prepared earth. The plants may be left to trail over the ground like Vegetable Marrow, but during wet weather a piece of flat stone or tile should be placed under each fruit to prevent it from rotting. Squashes are boiled green, like Vegetable Marrow, or mashed like Turnips, and served with milk, pepper and salt. When ripe, they are made into pies. In France they are sometimes gathered when of the size of an egg, boiled in salt and water, laid upon toast, and eaten as Asparagus.

Cucurbita moschata.—" Polong-wataka " *S.*—An oval or round gourd, with netted markings of pale green. Cultivation, etc., the same as for Pumpkin.

Cucurbita Pepo.—Vegetable Marrow (See under *Sub-tropical Vegetables*).

Lagenaria vulgaris. Bottle Gourd ; "Diya-labu" *S.*; "Sorakai" *T.*—One of the most popular of native vegetables, largely cultivated in the semi-dry districts of Kurunegala, Dumbara, etc., whence the local markets are chiefly supplied. The fruit is from 16 to 24 inches long, variously shaped, some forms resembling a decanter or water bottle. The unripe fruits, when boiled, are a palatable but insipid vegetable. When ripe and seasoned the shell becomes very hard and durable, and in this state is commonly made into vessels used for carrying water, or for collecting palm toddy, etc. The

plant is an annual, with white flowers (about $2\frac{1}{2}$ inches across), and may be grown on the ground or supported on trellises, etc.

Luffa acutangula. "Veta-kolu" or "Dara-vetakolu" *S.*; "Pekankai" or "Pey-pichukku" *T.*—A climbing gourd, bearing fruit 10 to 12 inches long, with several longitudinal angular ridges. DR. ROXBURGH said of this vegetable-fruit: "Peeled, boiled, and dressed with butter, pepper and salt, it is little inferior to green-peas." Too much reliance must not, however, be placed upon this statement. The plant is an annual and is grown somewhat largely in Cotta and Dumbara for supplying the markets of Colombo and Kandy respectively, the fruit being much used by the Natives, both in curries and as a vegetable. The plant is easily raised from seed, and does best on supports.

Luffa aegyptiaca. Loofah; "Niyan-vetakolu" *S.*; "Pikku" or "Pichukku" *T.*—A large annual herbaceous climber with angular stems, indigenous to the low-country and commonly grown in native gardens. The fruit, which is cylindrical and from 8 to 12 inches long, is used when tender as a vegetable. Propagated by seed or cuttings.

Momordica Charantia. Carilla Fruit; "Karawila" *S.*; "Pakal" or "Pavakai" *T.*—A rather slender vine, bearing an oval warty fruit, 6 to 8 inches long, orange-yellow when ripe. The latter in a tender state is much relished by the natives as a curry vegetable; it is also frequently pickled, being one of the most common ingredients in Indian pickles. There is a variety with white fruits, which render the plant very ornamental. Propagated by seed, which should be sown at the commencement of the rains. The plant may be allowed to trail on the ground, but is best on supports, especially during the wet season.

Momordica dioica. "Tamba-karawila" *S.* "Tumpai" or "Palupakkal" *T.*—A small oblong, green, warty-looking gourd, about 2 to 3 inches long, commonly used and much esteemed by the Natives as a curry vegetable, and is often sold in the boutiques or bazaars. The tender shoots and leaves are also edible. The plant is indigenous to Ceylon, being common in the dry districts. It is not suited to elevations much above 2,000 feet. Propagated by cuttings or seeds during the rains.

Sicania odorifera. Melocoton, or Casabanana.—A Mexican gourd bearing stout Cucumber-like fruits, from 10 to 15 inches long and about 3 inches in diameter. In the green and unripe state these afford an excellent vegetable, and in a ripe state are

suitable for preserves. When approaching maturity the fruit assumes a brownish or reddish tint, and possesses a pleasant fragrance. The plant is a rapid grower, and attains a height of about 50 feet. It thrives best and is most productive when grown in rich soil, fully exposed to the sun and allowed to ramble over an arbour or trellis. It is suited to a rather dry climate, though it has flourished and fruited in Peradeniya Gardens, where it was introduced a few years ago.

Trichosanthes anguina. Snake-gourd; Club-gourd; "Patola," *S*; "Podivilangu" or "Podalangai" *T*.—A quick-growing climbing gourd, bearing long cylindrical, green (sometimes greenish-white) fruits, which not unfrequently reach the length of five to six feet. In an unripe state these pod-like fruits are sliced and cooked in the manner of French beans, being also largely used as a curry vegetable in the low-country. Seeds are sown in the monsoons, either in rows in the open ground, or against low branching trees or shrubs. It is customary to suspend a small stone to the end of each fruit whilst growing, so as to weight it down and induce it to grow straighter, and perhaps longer, than it would otherwise do (*See illustration*).

Vegetable Marrow. See under *Temperate and Sub-tropical Vegetables.*

SECTION 3: ROOT OR TUBEROUS VEGETABLES AND FOOD CROPS.

Calathea allouya. (Scitaminae). "Topee Tamboo," or "Tokee Tambo;" "Lleren" (S. American names).—A perennial about 2 feet high, with large oval Canna-like leaves, native of tropical South America. The plant has been grown at Peradeniya since 1893, when it was introduced. It produces regularly a quantity of tubers which resemble small potatoes, but these as yet give no promise of becoming here the popular vegetable they are said to be in the plant's native country and in the West Indies, where it is recorded to have been cultivated for a long period, though not extensively. The tubers though edible are of a somewhat gritty nature, and seem to require endless boiling to render them tender. To a novice they seem to have no flavour, but people who have acquired a taste for them pronounce them delicious. In the report of the Porto Rico Experiment Station for 1903, it is stated that this peculiar plant is highly prized by the Natives of the interior, being "sold in the streets of some of the large towns, the crisp nut-like tubers ranking with ground-nuts in

SNAKE-GOURD. *Trichosanthes anguina.*

popularity." A loose rich soil suits the plants best. They may be planted at distances of about 2 feet, in rows 3 to 4 feet apart, and cultivated like any other vegetable. Propagation is effected by division of the plants or crowns; the root-tubers do not usually

"LLEREN," OR "TOPEE-TAMBOO." *Calathea allouya.*

grow. A crop may be harvested in about ten months from the time of planting (*See illustration*).

Colocasia.—See *Xanthosoma.*

Canna edulis. (Scitaminae). Queensland Arrowroot; Indian-shot; "Tous-les-mois;" "But-sarana" *S*; "Valay-sembu" *T.*—A herbaceous perennial, with large bronzy leaves, 3 to 5 ft. in

height, considered to have been originally introduced from the West Indies. It is commonly grown in native gardens, more especially about Tamil cooly lines, and the starchy purplish tuberous

QUEENSLAND ARROWROOT. *Canna edulis.*

roots, 6 to 10 of which are usually produced by a plant, are either cooked and eaten as a vegetable, or made into flour. The plant is cultivated somewhat extensively in Queensland, where it furnishes

the "Queensland arrowroot" of commerce. Though not generally so productive as the West Indian arrowroot, it is considered to be one of the best starchy foods for invalids and infants, owing to the larger size of the starch grains and their greater solubility in boiling water. The starch is also largely used for laundry purposes. The market price for this product in London ranges from about 4*d.* to 6*d.* per lb. The yield is said to vary from 15 to 20 cwt. of the prepared article per acre. According to the Porto Rico Experiment Station Report for 1903, *Canna edulis* will yield a crop of 15 tons of fresh tubers per acre under favourable conditions. The plant is propagated and cultivated in the same way as the ordinary Arrowroot. In Queensland the rhizomes (tubers) are planted out in rows 3 to 4 feet apart, with a distance of 2 feet between the plants in the row. The crop takes from six to eight months to come to maturity. According to the *Queensland Agricultural Journal*, 9 tons of tubers will yield 1 ton of prepared arrowroot, and a good crop should give about 1½ tons of the latter per acre. (*See illustration*).

Cyperus esculentus. (Cyperaceae). "Chufa," Ground-almond, Tiger-nuts.—A small perennial grass-like sage, indigenous to South Europe, Western Asia and various parts of Africa. Its small underground tubers are edible and may be cooked and used as a vegetable, having a nutty flavour. Roasted and ground, they are sometimes used for adulterating coffee. They also yield an excellent oil for culinary purposes. When dry, they look like large wrinkled peas. MR. TUDHOPE, Director of Agriculture for the Gold Coast, informs me that the plant is cultivated by the Natives of that country, chiefly in localities adjoining the sea-board, and that the tubers which "are not at all unpleasant to eat," are sold in the local markets. The plant thrives in almost any arid sandy soil, yielding a crop in 4 to 6 months and producing 100 to 150 tubers each. This species does not spread or become a troublesome weed like *Cyperus rotundus*, the "Kalanduru" of the Sinhalese.

Dioscorea. (Dioscoraceae). Yams; "Vel-ala" *S.*; "Kodi-kilengu" *T.*—Different species and varieties of the genus *Dioscorea* constitute the true Yams, which are climbing plants with large, edible, underground tubers. In Ceylon, however, almost any tuberous plant is called a "yam," as *Alocasia* ("Habarala"), *Manihot* ("Manyokka"), etc. The Dioscorea yams are largely cultivated in the West Indies and tropical South America, where they form a standard article of diet with all classes, the best varieties being

even preferred to good potatoes. In Ceylon and the Eastern Tropics, however, they have not as yet gained such popularity, either with the Natives or Europeans, and though often met with in native gardens, as well as in markets and boutiques, they are not a common commodity. Yams are easily cultivated, and thrive best in loose deep soil, up to an elevation of 2,500 to 3,000 ft. They may be planted against fences, trees, etc., or made to serve as screens for covering unsightly objects. The best season for planting is February and March. The ground being dug to a depth of $1\frac{1}{2}$ to 2 feet and raised in drills or mounds, 4 feet apart, pieces of the crown or "yam head" are planted in these at distances of 2 feet apart. Poles or stout bamboo tops are fixed in the ground along the rows for support to the vines. The crop is ready for harvesting in from 7 to 9 months, the leaves then becoming spotted brown, and the stems dying down to the ground. The tubers may be lifted and stored in a cool shed, under dry earth or sand; or they may be left in the ground and used as required, provided they can be protected from vermin and other enemies. Yams can be cooked and prepared for food in various ways, being either roasted, baked, or boiled and steamed, etc.

VARIETIES. There are numerous species and varieties of yams, some half-dozen species being indigenous to the moist low-country jungle of Ceylon. Most of the cultivated forms are somewhat variable in their vegetative characters, colour and shape of tuber, and a great number of these probably belong to the species *D. alata*. The local vernacular names are numerous and confusing; those here given include the principal names known in Ceylon. Among the choicest varieties are :—Kiri-kondol, Hingurala, Japana-ala, Java-ala, and Kukul-ala. Yampee or Cush-cush is a favourite yam in the West Indies.

The following yams are grown in the Royal Botanic Gardens, Peradeniya: Stem 3 to 5 winged or angled, tuberiferous, without prickles; leaves opposite, entire.—*Dioscorea alata*, *var* :—

"Angili-ala" *S.* (= "Verralvalli-kelengu" *T*), "Bindhar" or "Binnar-ala" *S*, "Hingur" or "Ingur-ala" *S*, "Japana" or "Rathu-ala" *S*. (="Sayuyalli-kelengu" *T*), "Kaharata-ala" *S* (= Karavalli-kelengu" *T*.), "Kiri-kondol" *S* (= "Arthuvalli-kelengu" *T*) or White yam, "Kirivel-ala" *S* (= "Vaithilay-valli-kelengu" *T*), "Niame-Chino" and "Niame Pellu" (Cuban names), "Raja-ala" *S*, "Rata-kondol" *S*, "Ratavel-ala" *S*, "Vel-ala" *S* (= "Kodivalli-kelengu" *T*), and Yellow-yam (= *D. Cayennensis*).

Leaves 3 to 5 lobed, stem winged:—Yampee or Cush-cush yam (=*D. trifida*).

Stem round, tuberiferous, without prickles, leaves alternate :—"Udella" or "Uda-ala" *S* (= "Kodikarrana-kelengu" *T*)= *D. bulbifera*.

Stem round or slightly grooved, tuberiferous, with prickles, leaves alternate

or opposite, entire :—"Hiri-tala" *S* (= "Sheenivalli-kelengu" *T*) =*D. obcuneata.* "Java-ala" *S*, "Natt-ala" or "Maha-kukul-ala" *S*, (= "Shoravalli-kelengu" *T*), "Katukukul-ala" *S*, and "Kukul-ala" *S* (= "Shirruvalli-kelengu" *T*) = *D. fasciculata.* "Jambur-ala" *S*, (= "Podhalivalli-kelengu" *T*), "Kaha Japana-ala" *S* (= Guinea Yam)=*D. aculeata.**

Leaves three to five digitate :—"Katu-ala" *S* (= "Mulluvalli-kelengu" *T*) =*D. pentaphylla.*

Stem round, not prickly, without aerial tubers, leaves opposite :—"Gon-ala" *S* (= "Kombuvalli-kelengu" *T*)=*D. spicata.*

Inedible Ceylon yams:—"Uyala" *S* (= *D. tomentosa*), "Panu-kondol" *S* (=*D. sativa*), and *D. intermedia.*

Helianthus tuberosus. Jerusalem Artichoke; "Hartha-wariya" *S.* (See under *Sub-tropical or Temperate Vegetables*).

Ipomoea Batatas. (Convolvulaceae). Sweet Potato; "Batala," *S*; "Velkelengu" *T.*—A creeping or trailing perennial, bearing succulent tuberous roots, which are a tasty and nutritious article of food, being sometimes preferred by Europeans to the common or Irish Potato. The Sweet-potato is considered to have its native habitat distributed over the tropics generally. It is cultivated in all warm countries, and may be grown successfully in sheltered valleys up to about 4,000 feet in Ceylon, but does not usually thrive in the hills. Any moderately good soil will suit the plant, provided it is of a light sandy nature. The ground should be well dug, manured, and formed into ridges at distances of about 2 ft. ; along the centre of the ridges cuttings about 12 inches long are planted a few inches apart, and these readily strike root. During dry weather, the plants should be watered, or, when possible, the ground irrigated once a week. The crop is ready for harvesting about 3 to 4 months from the time of planting, the leaves turning yellow when the tubers are mature. A yield of about 4 or 5 tons of tubers per acre may be expected under favourable conditions.

VARIETIES. The following are among the best varieties grown at Peradeniya :—"Boniato," "Sierra morena," "Boniato Amarillo," "Virginia," and "Nancimund." There are numerous varieties recognised in the West Indies and America, such as "Blue Belle," "Red Burbon," "White Gilkes," "Annie Vine," "Prince Henry," etc.

Manihot utilissima (Euphorbiaceæ). Tapioca ; "Cassava;" "Manyokka" *S.*—A shrubby perennial, 6 to 8 feet high, native originally of tropical South America, where its cultivation dates far back. It is supposed to have been first introduced into India and Ceylon by the Portuguese. There are two distinct kinds in cultivation, known as the "Bitter" and "Sweet" Cassava (*Manihot utilissima*

* *D. cayennensis* (Burkhill).

CASSAVA OR TAPIOCA. *Manihot utilissima.*

and *M. Aipi* respectively), and of these there are many varieties. All are characterised by the presence of prussic acid, some possessing it to a greater extent than others, and this not infrequently results fatally to persons eating the cassava carelessly prepared. The "Bitter" variety contains a greater percentage of the poison than the "Sweet," and as it exists chiefly in the outer portion of the root of the latter it is easily eliminated. The Cassava is cultivated in all tropical countries, either as food for man and stock, or for the manufacture of starch. It is extensively grown in Tropical America, the West Indies, and the Straits Settlements, and has been the chief article of diet of the aboriginal races of the former countries from time immemorial. In India and Ceylon its cultivation is rather limited and generally confined to native gardens, being grown chiefly for home consumption. The large tuberous roots are cooked and used as a vegetable, or made into cassava meal and bread. The tapioca of commerce is obtained by a process of grating and sifting of the tubers, the poisonous juice being removed by pressure, washing, and fire heat. Tapioca is largely exported from Brazil, and in recent years from the Straits Settlements, where the Chinese have advanced its cultivation. When the tubers are used as a vegetable, it is especially important that they be fresh. If kept for more than a few days after being taken from the ground they become dangerous to eat, and it is probable that many of the fatal cases from eating cassava are due to neglect of this precaution. It is said that the Natives of Guiana take red chillies steeped in rum as an antidote to cassava poisoning. Cassareep, a powerful antiseptic, capable of preserving meat, etc., is a by-product obtained by boiling down the poisonous juice of the "Bitter Cassava"; it is used in the making of many celebrated sauces, and in the well-known "Pepper-pot" of the West Indies.

Cassava is an exhausting crop, and cannot usually be grown profitably for more than three successive years in the same ground. In the Straits, it has in many cases been grown as a catch crop in young rubber plantations. The plant resists drought well, thrives at all elevations up to about 2,000 feet, and prefers an open sandy soil. It is propagated by cuttings of the stem, which are planted at a distance of about 16 inches in rows about 4 ft. apart. The tubers are ready for harvesting in 8 to 10 months from date of planting, some varieties taking 15 months or more to mature a crop; a good crop is considered

to yield from 10 to 12 tons or more tubers per acre, a single plant often producing from 30 to 50 lb. The yield of prepared tapioca varies from 1,600 to 2,600 lb. per acre. Cassava is largely cultivated in the Philippines and Java for the production of starch, the yield of which is about 34%. There are numerous varieties of Cassava in cultivation, some 6 or 7 occurring in Ceylon, none of which appear to be distinguished by vernacular names.

Maranta arundinacea, (Scitaminae). West Indian, or Bermuda Arrowroot; "Araluk" or "Hulankiriya" *S.*—A small stemless herbaceous plant, with large leaves, native of Tropical America. The name "arrow-root" is derived from the fact that the rhizomes were used by the Indians as an application to wounds inflicted by poisoned arrows. The plant is cultivated in most tropical countries for the sake of its white starchy underground tubers (rhizomes), which are either used as a vegetable, or (by a process of washing, grating and sifting) made into arrowroot. The arrowroot of commerce is obtained chiefly from the West Indies, notably Bermuda and St. Vincent, where the plant is systematically cultivated. Propagation is effected either by means of the tubers or by division of the crown, these being planted 5 or 6 in. deep in rows or furrows 3 ft. apart, with about 14 in. between the plants in the row. The commencement of the rainy season should be selected for planting. A light, loamy, well-drained soil is best, wet or clayey soil being unsuitable. The crop is an exhausting one, and the richer the soil the better. The plant will thrive from sea-level to about 3,000 feet in Ceylon. Shade is not essential, though in light and exposed soils it is beneficial. The flowers should be removed from the plants as they appear. The tubers are usually ready for harvesting in from 8 to 10 months from the time of planting, their mature condition being indicated by the leaves flagging and dying down. It is estimated that an acre will produce on an average about 5 tons of fresh tubers, which contain about 15 to 20 per cent. of dry starch, yielding a return of about 16 to 20 cwt. of prepared arrowroot per acre. Arrowroot fetches at present about 3*d*. to 4*d*. per lb. wholesale.

Oxalis crenata (Oxalidaceæ). "Oka."—A small Peruvian plant, allied to the common Oxalis weed (*O. violacea*, so troublesome at the higher elevations in Ceylon), producing numerous small tubers, which are edible and grow to the size of small plums. The plant is cultivated as a vegetable in Peru, where the tubers are boiled for about 20 minutes, and eaten with pepper and salt, etc. The

acid succulent leaf-stalks are used as a salad. The plant is said to thrive in almost any free soil, and is readily propagated by the tubers.

Plectranthus tuberosus (Labiatae, Coleus family). Country Potato; "Innala" *S.*—A small herbaceous plant with succulent aromatic leaves, commonly grown in low-country native gardens for the sake of its small watery, but edible, underground tubers. The latter are often retailed in the markets and boutiques, being used as a vegetable in curries; they appear to have little to recommend them as an article of food; but their quality might possibly be improved by cultivation and selection. In Africa, Madagascar, Cochin China, etc., this and other species of Plectranthus are said to be grown and relished by the Natives. The plants are easily propagated by cuttings or tubers, and may be grown like Sweet-potatoes, being planted about 8 in. apart in a bed of light rich soil.

Tacca pinnatifida (Taccaceae). "Garandi-kidaran" *S.*—A stemless tuberous plant, with leaves 1 to 3 ft. long and parted into three segments, native of the dry region of Ceylon (Bintenne, Batticaloa, and Jaffna), being found in open grassy places. It is also indigenous to India, Burma and Malaya, and is commonly cultivated in parts of India, Tropical Africa, Pacific Islands, etc. The plant has a large round tuberous root, which yields a considerable quantity of white nutritious fecula. This is considered to be equal to the best arrowroot, which it somewhat resembles, and is said to form an important article of local trade in Travancore, Fiji, Hawaii, and elsewhere. The tubers, dug up after the leaves have died down, are rasped and macerated for 4 or 5 days in cold water, when the fecula separates, being then prepared in the same manner as sago. In the crude state it is intensely bitter and acrid, but these qualities are removed by the process of soaking and washing. The plant is suited to a rich porous soil, and may be planted in rows about 3 ft. apart. Propagated by division of the root-stock.

Xanthosoma. (Aroideae). "Tannias" or "Tanniers;" "Cocoes;" "Eddoes;" "Yautias;" "Taroes"—These are some of the numerous vernacular names applied in the Pacific Isles, S. America and the West Indies to different species or varieties of *Xanthosoma* and *Colocasia*. In Ceylon, as elsewhere, much confusion exists in regard to the names of these plants, which here are all generally referred to under the vernacular names of "Habarala," "Gahala," etc. Mr. Barrett, of the Porto Rico Experiment

Station, considers that the name "Taro" rightly belongs only to varieties of *Colocasia esculentum*, a native of the Old World; whilst the rest of the names given above should be exclusively applied to species or varieties of *Xanthosoma*, all cultivated forms of which may be considered as having been derived from the three species *X. sagittaefolium*, *X. atrovirens*, and *X. violaceum*. Thus the Taro (*Colocasia*) and its varieties are distinct by having the leaf peltate, i. e., with the petiole (leaf-stalk) attached to the margin; whilst with the *Xanthosoma* ("Tannias," "Yautias," "Cocoes," etc.) the leaf is never peltate, but has the leaf-stalk attached to the margin of the blade, and the latter is usually prolonged into two lobes at the base.

This group of handsome tropical plants are among the oldest cultivated crops of the world, and are found everywhere in a more or less cultivated state throughout the tropics. They furnish edible under-ground tubers (rhizomes), not unlike artichokes, and the young tender leaves are boiled and eaten as spinach. Though a stand-bye vegetable in native gardens, it does not find much favour with Europeans. In Hawaii and parts of South America, Yautias are grown somewhat extensively, either for food or for the commercial starch obtained from the tubers. The plants do best in a rich humous moist soil, and may be planted all the year round; they will thrive in Ceylon up to 3,000 feet or higher, and to some extent in the drier districts if irrigated. Propagation is effected by means of the tubers or division of the crowns. In the West Indies, Tannias are recommended for planting out as shade for young plantations of Cocoa, etc.

VARIETIES:—There are numerous varieties in cultivation, the following being the principal ones occurring in Ceylon.

Colocasia: Leaves peltate, leaf-stalks and tubers eaten:—"Kiri-ala" (very pale green leaves), "Kandala," "Thadala," "Kalu-ala" (leaf-stalks purple), "Kalu-khandala" (leaf-stalks purple), "Yakutala," "Garendi-kandala," "Gahala," "Ala-kola" or "Gahala-kola," "Thumas-ala." The last named is considered one of the best, producing a crop of tubers in three or four months, as the name indicates.

Xanthosoma. leaves hastate or sagittate; tubers edible, leaf-stalks occasionally eaten.—"Rata" or "Daesi-ala," "Habarala" (leaves very large), "Kalu-habarala" (leaf-stalks purple).

Alocasia cucullata:—"Panu-habarala. "Leaves heart-shaped; used medicinally only.

Alocasia macrorhiza variegata:—"Eli-habarala; large handsome variegated leaves; used only in native medicine.

Alocasia sp. "Mavil-habarala," also a medicinal species, distinct by a spotted leaf-stalk, the vernacular name being derived from the supposed resemblance of the latter to the "Mapila" snake.

SECTION 4. MISCELLANEOUS VEGETABLES AND FOOD CROPS.

Amaranthus oleraceus. (Amarantaceae); "Thampala" *S.*—An annual herbaceous plant which, with several other species or varieties of the same genus, is commonly grown by the Natives in the low-country. The tender leaves and succulent portion of the stem are boiled and used in curries and other ways. In India, the succulent tops of the stems and branches are said to be sometimes served up as a substitute for Asparagus. The Amaranthus is easily cultivated, being readily raised from seed, and thrives in any ordinary soil. Some varieties come up spontaneously in ground where they were previously grown.

Basella alba. (Chenopodiaceae). Ceylon Spinach; Malabar Night-shade; "Niviti" *S.* "Pasali" *T.*—A slender climbing perennial, with succulent stems and leaves, which may be used as a potherb or spinach, for which they are a good substitute. It is often cultivated in the low-country of Ceylon and is relished by Natives and Europeans. Propagated by seed sown during the rains, preferably in rows, sticks being provided for support to the vines.

Arachis hypogaea. (Leguminosae). Ground-nut; Earth-nut; Monkey-nut; Pea-nut; "Rata-kaju" *S*; "Nella-kadala" *T.*—A small annual trailing plant, native of Brazil and now cultivated in all tropical countries. It is remarkable for its habit of burying its seed-pods in the ground to ripen, hence the name "ground-nut." The cultivation and export of ground-nuts is an important industry in West Africa, Southern India, Burma, and elsewhere. Recently in Ceylon, ground-nuts were strongly advocated as a suitable inter-crop with stationary products, as Rubber, but have not proved a commercial success. The plant is, however, often grown in native gardens in the low-country. In Tropical America, the West Indies and throughout Tropical Africa, Ground-nuts are commonly cultivated both as an article of food and for the valuable oil obtained from the seed. The "nuts" (seeds) are prepared and used for food in numerous ways. In the United States they are used largely in confectionery, being also roasted and eaten as dessert. Ground-nut oil is one of the best of salad oils, being considered almost equal to olive oil, but its chief use is in the manufacture of toilet soaps, pomades, cold cream, etc. After the expression of the oil from the seed, the residue forms a valuable manure or cattle-food.

A light friable, well-tilled soil is the most suitable for the plant, the presence of lime being especially beneficial. The ground should be well forked to a depth of 6 inches or more, and the seed, after being shelled, may be sown about 3 in. deep in rows $1\frac{1}{2}$ to 2 ft. or more apart. Just before the commencement of the rainy season is the proper time to sow. From 70 to 80 lb. seeds should be sufficient to sow an acre. About 3 to 5 months, according to the variety grown and nature of soil, are required to produce a crop. When ripe, the plants are dug up and the nuts picked by hand. The yield per acre may vary from 1,500 to 4,000 lb. of "nuts;" 3,000 lb. is said to be a good average yield, though with high cultivation as much as 6,000 lb. per acre is stated to have been obtained. Several varieties are known in cultivation, these being distinguished by differences in productiveness and by a spreading or erect habit of the plants. The "Mauritius" and "Brazil" varieties have been found the best of those tried at the Peradeniya Experiment Station.

Capsicum grossum, or C.—frutescens. (Solanaceæ). Capsicum, Chilli, Bell Pepper, "Malu-miris" *S*, "Karri-kochika" *T*.—There are numerous varieties of Capsicum or Bell-pepper, which are related and similar to the small pungent varieties of Pepper chillies (see under *Spices*), but distinguished from them by the large pod-like fruits. The latter are hollow, usually oblong, 3 to 5 inches long or more, and vary in colour from orange, bright red, amber, to dark-purple. These are edible and pungentless, being generally relished in salads or as a vegetable. The plants are annuals, 2 to 3 ft. high, and thrive best in loose rich soil, under light shade. Suited to elevations up to 4,000 ft., provided the rainfall is not excessive. Seed of excellent varieties may be obtained from nurserymen in Europe.

Edible Seaweed. Several species of Seaweed furnish an article of food to the inhabitants of certain tropical regions. In the Malay Archipelago, China, and Japan, certain seaweeds are said to form a staple article of diet, the sorts used coming under the heads of "blue-green," "brown," and "red." When soaked in hot water these become highly gelatinous, and are eaten in various forms, or used for thickening soups. The blue-green varieties are said to contain the highest percentage of proteids. Seaweed jelly is sometimes used for adulterating fruit jellies.

Edible birds' nests. Though scarcely a vegetable product, edible birds' nests rank as an important article of table delicacy in China, where they are made into a celebrated soup. These

nests are formed by species of swifts (*Collocalia*) inhabiting caves, and their nutritive value is derived from the dried salivary secretion of the birds. Young, *white nests* are the most highly prized, and these are sold at very fanciful prices, varying from about £35 per thousand, "the best quality commanding their weight in silver." The annual import to Canton alone is said to be about 9,000,000 nests. Edible birds' nests have until recently been exported from Ceylon, being collected, under Government licence, from caves chiefly in the Southern Province.

Hibiscus esculentus. (Malvaceæ). Okra or Ochro; Gobba, or Gumbo; Lady's Fingers; "Bandakka" *S*; "Bandak-kai" *T*.—An erect annual of the "Shoe-flower" family, 2 to 3 ft. high, bearing large leaves and erect horn-like pods. The latter grow from 5 to 8 in. long, and when tender are an agreeable vegetable; when boiled, they are of a mucilaginous consistency and are used for thickening soups, or in salads. This popular vegetable is grown throughout the tropics, and occurs in numerous varieties. The plant is not suited to high elevations in Ceylon, except in sheltered valleys. Sow seed at the commencement of the rains, thinly in rows about 3 ft. apart, subsequently thinning out the plants to distances of 12 or 14 inches; or sow in a bed, and afterwards transplant the seedlings into rows in well-prepared soil, allowing the dwarf kinds to be about 15 in. apart, and the larger kinds 18 to 20 inches. The plant does best in rich or heavily manured soil. The pods are best for use while they are soft and tender, before the seeds are half-grown.

Ipomoea aquatica. (Convolvulaceae). "Kan-kun" *S*.—A small semi-aquatic creeper, with tender arrow-shaped leaves, often cultivated in native gardens. The leaves and young stems are commonly used for vegetable curries. Thrives best in a shallow trench where moisture can be retained. Propagated easily by cuttings.

Ipomoea Bona-nox. (Convolvulaceae). Moon Flower; "Alanga" *S*. "Alangai" *T*.—A perennial climber, the fleshy calyces of which are often used as a vegetable for curries, soups, etc. It is sometimes cultivated, chiefly by Tamils, in small native gardens. Easily propagated by cuttings or seed. Will thrive up to 3,000 feet.

Moringa pterygosperma. (Moringæ). Horse-radish Tree; Drumsticks; "Murunga" *S*; "Murunga-kai" *T*.—A short slender tree with small tri-pinnate leaves, found cultivated in gardens throughout Ceylon, India, etc. The roots are used as a substitute

for horse-radish, the leaves for vegetable curries as well as for seasoning and in pickles. The long unripe pods ("drumsticks") are very commonly used as a curry vegetable, being boiled and cut up like beans. The flowers and bark are used in native medicine, and a valuable oil known as "oil of Ben" is obtained in India from the seeds. Propagated by seed or cuttings.

Passiflora quadrangularis. (Passifloraceae). Granadilla; "Garandilla" *S.*—A large perennial climber, whose gourd-like green fruit in an unripe state may be boiled and served as a vegetable (See under *Tropical Fruits*).

Sesbania (Agati) grandiflora. (Leguminosæ). "Katuru-murunga" *S*; "Agatti-keerai" *T.*—A small, quick-growing, soft-wooded tree, about 15 to 20 ft. high, bearing large pendulous flowers, the fleshy petals of which are much esteemed for use in curries and soups; both the flowers and tender leaves are very palatable when fried. The long pendulous pods do not appear to be eaten. The bark, leaves and flowers are medicinal. Propagated by seed. (*See illustration.*)

KATURU-MURUNGA.—*Sesbania grandiflora.*

Solanum Melongena. (Solanaceae). Brinjal; Egg-plant; "Wambotu" *S*; "Katrikai" *T.*—A low bushy perennial (an annual in cultivation), commonly grown in native gardens for its smooth polished fruit, which is cooked and served in various ways, and forms a favourite vegetable. There are numerous varieties, differing chiefly in the

shape, size and colour of the fruit. The latter is round in some varieties, egg-shaped or cucumber-shaped in others, whilst the colour varies from white to dark-purple, the latter colour being usually characteristic of the best varieties. Brinjals thrive best in a rather dry climate, and require a light, rich well-tilled soil. They are grown most successfully in the Negombo and Dumbara districts of Ceylon, and are suited to fairly high elevations, provided the climate is not too wet. Sow seed in a well prepared bed, and transplant the seedlings when about three inches high into rows 18 inches apart, with 15 inches between the plants in the row. The plants should begin to bear in from 3 to 4 months, and continue to yield a crop for about 3 months.

Sorghum vulgare. (Gramineæ). Guinea Corn; Great Millet; Turkish Millet; "Cholam" *T.*—A tall annual plant of the grass family, 6 to 9 ft. high, cultivated from remote ages as a cereal food-crop. It requires the same conditions of climate and soil as Maize, and is largely cultivated in India, Burma, Africa, etc., but is seldom grown in Ceylon. It is not considered well suited to rice-growing regions. The small hard grain is very nutritious, and is made into flour, while the straw affords good fodder. In India the plant is often grown mixed with a pulse crop, as *Cajanus indicus*, the seeds of both being mixed and sown in drills 14 to 18 inches apart. About 7 or 8 lb. of Sorghum seed mixed with about 3 lb. pulse seed is considered sufficient to sow an acre. A crop is obtained in about five months from the time of sowing, the yield obtained varying from 500 to 900 lb. or more per acre, according to variety and soil. Several varieties occur in cultivation, these being distinguished by white, cream, red, or black seeds.

Voandzeia subterranea. (Leguminosæ). Vandzon; Madagascar-, or Bambarra-ground-nut.—A creeping annual with upright long-stalked leaves, the latter composed of three leaflets. Like the common ground-nut, the flower-stalks after flowering bend down to the earth, in which they develop and ripen their pods; on the other hand, the plant does not produce trailing branches and fruits are set close to the stem. The seeds or "nuts" are a common article of food with the Natives of Madagascar and different parts of Tropical Africa, where the plant is cultivated. In Zanzibar, there is a small trade in the product. The plant has been carried by the Negro slaves to certain parts of Tropical South America, where it is said to have become naturalised. It is known in Surinam as "Gobbe," in Natal as "Igiuhluba," and in Madagascar

as "Pistache Malgache." In yield and requisite conditions for cultivation the plant resembles the common ground-nut or Arachis.

Kerstingiella geocarpa. A kind of ground-nut similar to the preceding species in habit, etc., found and cultivated in Togoland, where it is known as "Kandela." It is a prostrate leguminous herb, rooting at the nodes, bearing white, red or black seeds.

Zea Mays. (Gramineæ). Indian-corn; Maize; (Mealies of S. Africa); "Bada-iringu" *S*; "Cholum" *T*.—An annual monœcious grass, 8 to 10 ft. high, native of Mexico. The unripe tender heads or cobs are, when properly cooked and served, considered by most persons a delicious vegetable. They are cooked and prepared in numerous ways, as boiled in milk, roasted, and then served with butter, pepper and salt. The ripe grains are made into flour by the Sinhalese, buns made from this being known as "Iringu-roti." The plant is grown to greatest extent and perfection in the warmer parts of America, where it is an important article of diet, especially the "Sweet" or "Sugar" varieties. It has also been long cultivated in the Eastern Tropics, where however the best varieties soon degenerate; good seed should therefore be imported frequently from America. Among the best and most distinct varieties as recognised in America and Australia are:—"Pride of the North," "Jowa Silvermine," "Longfellow Dent," "Hickory King," "Golden Flint," "Mastadon," and "Waterloo." Indian-corn is naturally subject to cross fertilisation, so that it runs into numerous varieties if left to itself. It is suited to a rather dry climate, like that of Dumbara in Ceylon, and may be grown at all elevations up to 5,000 feet or more. Sow the seeds at the commencement of the monsoons, in drills about 3 to 4 ft. apart, with about 6 inches between the grains in the row, the drills being about 3 inches deep. When the plants are well up, they should be thinned out to distances of about 12 inches apart. In indifferent soil, seeds may be sown 3 or 4 together in holes 12 in. apart, with $2\frac{1}{2}$ ft. between the rows, say 8,700 holes to the acre. A return of from 80 to 100 bushels of grain per acre is considered a good average yield. Each plant should produce from 2 to 5 cobs; the cobs are from 8 to 12 in. long.

CHAPTER XIII

TEMPERATE OR SUB-TROPICAL VEGETABLES AND FOOD CROPS

[*S*=SINHALESE ; *T*=TAMIL].

Suited to elevations of 3,000 feet upwards, with an annual rainfall of about 60 to 100 inches. Many may be grown with moderate success in the cool seasons at lower elevations, some even at sea-level.

[For convenience of reference it is considered preferable in this case to give precedence to the common or English name over the botanical, the former being better known. The botanical name and Natural Order are enclosed in brackets].

Aracacha, or Peruvian Parsnip (*Arracacia esculenta.* N. O. Umbelliferæ).—This uncommon vegetable is a native of the Andes in South America, where it is cultivated between 5,000 and 7,000 feet altitude. It is a low, Parsnip-like plant, producing large edible, starchy, carrot-shaped roots, the flavour of which has been compared to a combination of parsnips and potatoes. MR. W. NOCK, late of Hakgala Gardens, introduced it as seed from Jamaica in 1884. DR. TRIMEN stated that "its peculiar flavour and cheesy consistence did not seem to be relished by Europeans, though much enjoyed by all Natives who had tasted it." It is propagated either by seed or by division of the small heads (leaf-stalks), which spread out from the crown, the sets being planted about 6 in. deep in rows about 3 ft. apart. The plant requires from 10 to 12 months to reach maturity, but the tubers may be gathered for use 2 months earlier than this if required. In the native country of the plant, it is customary to gather the leaves together and twist them moderately, a process said to prevent the plants from running to head, while also favouring the development of the root. The plant will thrive in any good soil, and is adapted only to the higher elevations, say from 4,500 to 6,000 feet. It is commonly cultivated as a vegetable at Bogota, in Colombia, up to 8,000 feet elevation.

Artichoke, Chinese. (*Stachys tuberifera.* N. O. Labiatæ).—A dwarf herbaceous plant, bearing underground white spiral-like tubers, 2 to 2½ inches in length and about ½ an inch in thickness. They are eaten either cooked as a vegetable, or raw like radishes, being said to somewhat resemble the latter in flavour with a suggestion of the Jerusalem Artichoke. The plant has been found to succeed at Hakgala Gardens, where MR. W. NOCK reported in 1889 thus: "The ground is literally full of the small edible roots." This vegetable is not much grown in England, but is popular in France.

Artichoke, Globe (*Cynara Scolymus.* N. O. Compositæ).—The tender part of the globular unexpanded flower-head, after being boiled and eaten, is much relished as a vegetable. The plant thrives to perfection at Nuwara Eliya, growing sometimes in a semi-naturalised state, but is unsuited to elevations below 4,000 feet. Propagated by seed or suckers, preferably the former. Seed should be sown early in the year in boxes or pots under cover, but exposed as much as possible to the light, otherwise the seedlings are apt to damp off. The seed should germinate in 10 or 12 days after sowing. Prick out the seedlings when strong enough into a well-prepared and sheltered bed, and when these are about 4 in. high, plant them out 3 ft. by 4 ft. apart in rows. Good heads should be produced in about 8 months from the time of planting. The plants thrive best in a rich moist soil, as by the side of water channels or streams.

VARIETIES.—"Green Globe" and "Purple Globe" are both good.

Artichoke, Jerusalem (*Helianthus tuberosus.* N. O. Compositæ).—This much-relished esculent is one of the most successfully cultivated of European vegetables at low or intermediate elevations (2,000 to 4,000 ft.) in Ceylon where, curiously enough, it thrives better than at higher elevations. The plants like a rich free moist soil and, under congenial conditions, grow 5 to 6 ft. in height. In the tropics, however, they only reach a height of 2 to 3 ft. and the stems are inclined to a trailing habit. Plant the tubers in May at intervals of 16 inches, in lines about 2½ ft. apart. Pick off any flowers that may appear on the plants. A crop of tubers may usually be obtained in 5 to 6 months from the time of planting, and when these are taken up they should be covered with earth. In the tropics the tubers deteriorate to some extent after each crop, so that new sets should be imported every year if possible.

Asparagus. (*Asparagus officinalis*, N. O. Liliaceæ). "Harthawariya," *S.*—The cultivation of this delicious vegetable is seldom successful in the tropics. The plant is, however, occasionally grown with some measure of success in Ceylon at elevations of 4,000 to 5,000 ft. The young tender culms or shoots are the parts used. The plant requires a rich, friable and well-drained soil, which

ASPARAGUS, SHOWING A FINE CROP OF EDIBLE SHOOTS

should be heavily manured; being a native of the sea-coast, it is considered to derive much benefit from a sprinkling of salt applied to the surface soil once a year. Propagated by seed, which should be sown in boxes under shelter. When the seedlings are a few inches high, they should be planted out in large and deep holes, when care must be taken not to injure the delicate

roots. In Europe the seed is generally sown where the plants are to remain. A bed of Asparagus is considered to be in its prime at five years old, and lasts for a number of years. None of the shoots or branches should be cut during the first 2 years after sowing, so as to encourage the plant to make vigorous crowns or root-stocks.

Beans, Broad (*Vicia Faba.* N. O. Leguminosæ).—Broad-beans are grown successfully in only very few gardens at the higher elevations in Ceylon ; the plants set fruit but sparsely, even in the cool dry months, and when pods are produced they are usually small and lacking in flavour. By pinching back the tops of the plants when in blossom, and artificially pollinating the flowers, the production of pods may, however, be considerably increased. The best time to sow seed is in October or November. Seeds should be soaked in hot water for some hours, and then sown 4 inches apart in drills, with 18 inches between the latter ; cover the seeds with 3 inches of soil. There are two distinct kinds, the "Long Pod" and "Broad Windsor ;" the former is considered the better suited to cultivation in the tropics.

Beans, Kidney or French. (*Phaseolus vulgaris.* N. O. Leguminosæ). "Bonchi," *S.*—This excellent vegetable can be grown in the moist and cool season at all elevations from sea-level, but to most perfection at 5,000 to 6,000 feet, being commonly cultivated in market gardens about Nuwara Eliya. The varieties come under two distinct classes, viz.—(a) "Dwarf" sorts, which attain a height of 12 to 16 inches and do not need stakes for supports ; (b) the tall or "Runner-Beans," which are climbers and grow 6 or 8 ft. in length, requiring supports as Peas. The conditions of culture for the tall and dwarf sorts are the same. The latter come into bearing sooner and are more prolific than the Runner-beans, which, however, remain productive for a longer period. The seeds should be sown in rows, in well-manured soil, with a distance of 1½ to 2 ft. between the rows. Frequent sowings should be made so as to keep up a succession of crops ; sowings made towards the end of the monsoon rains should give the best returns. The seeds germinate quickly, and the plants usually come into bearing in about six weeks from the time of sowing. Among the best of the Dwarf sorts are:—"Canadian Wonder," "Butter Beans," ("Mont d' Or"), "Sutton's Perfection," and "Veitch's Hybrid." Runner Beans :—"Chelsea Giant White," "Epicure," "Excelsior," "White Long Pod," etc.

Bean, Scarlet Runner. (*Phaseolus multiflorus.* N. O. Leguminosæ).—A herbaceous perennial climber with scarlet flowers, native of South America. The tender pods are used like those of French-beans, etc. The plant is seldom cultivated in Ceylon, as it has been found unsuited to the climate at any elevation, though it has been grown with fair success at Peradeniya, where it has blossomed freely but seldom produced fruit.

Beet, or Beetroot. (*Beta vulgaris.* N. O. Chenopodiaceæ). This grows extremely well in up-country gardens, and at low elevations also it yields very fair roots, which are the parts used. The plant generally thrives best in a rather heavy moist soil and, being naturally a native of the sea-coast, is supposed to be benefited by an application of salt to the soil. A suitable chemical manure mixture is: Kainit (3 parts), superphosphate (5 parts), sulphate of ammonia (2 parts), using 3 to 4 oz. per square yard. The ground should be dug deeply, burying the manure well under. Secure an even and fine surface by means of an iron rake, and draw small drills about 1½ in. deep, and 10 inches apart; into these sow the seed thinly and evenly, and cover with fine soil, afterwards pressing down the surface. The seed germinate in a few days. The seedlings must be thinned out when well above the surface, and these may be transplanted if desired.

VARIETIES.—"Electric," "Dell's Crimson," "Middleton Park" and "Turnip-rooted" are excellent sorts. On the plains in India, acclimatised seed is considered to give the best results.

Leaf-beet. (*Beta cicla.* N. O. Chenopodiaceæ). This variety of Beet is grown for its leaves which are used in soups, etc., for flavouring. Cultural requirements similar to those given for the common Beet.

Borecole, Kale, or Curly Greens. (*Brassica oleracea acephala.* N. O. Cruciferæ).—A variety of cabbage characterized by very crumpled or curly leaves, which spread out in plume-like fashion, and do not form a compact head. These are not considered fit for use in England until they have had some frost. Owing to their ornamental appearance, they are frequently employed for garnishing as well as for cooking purposes. The plants can be grown successfully at medium and high elevations. Not commonly grown in market gardens in Ceylon. Cultural directions the same as for Cabbage.

Broccoli. (*Brassica oleracea Botrytis.* N. O. Cruciferae).—This is practically a kind of Cauliflower in which the flowers do not

form a compact head ; it is best suited to a winter climate in cool countries, and is unsuitable for cultivation in the tropics.

Brussels Sprouts. (*Brassica oleracea gemmifera.* N. O. Cruciferæ).—This favourite vegetable is a variety of Cabbage which, instead of forming one single head, produces numerous small heads or "sprouts" crowded along the stem towards the top. It is a winter vegetable in Europe, but also thrives at high elevations in the tropics, and is commonly grown in up-country gardens in Ceylon. Cultural requirements are similar to those of Cabbage. "Sutton's Matchless," "The Aigburth," and "Dwarf Gem" are all good varieties.

Cabbage; "Goa" S. (*Brassica oleracea.* N. O. Cruciferæ).—This useful vegetable is now grown abundantly at high elevations in Ceylon, both in private and market gardens. At low or intermediate elevations also it thrives sufficiently well to yield at least a crop of green leaves, which are so much prized by the Natives for soups and vegetable curries. A rich, well-drained and manured soil is essential. The seed may be sown thinly on a sheltered border with finely worked, loose soil ; when the plants are 4 or 5 in. high they should be planted out about 15 in. apart in rows, the distance between the latter being about 18 or 20 inches. The young plants will require to be protected from the sun and wind until strong enough to take care of themselves. In the low-country, Cabbages are often propagated by cuttings or small shoots which appear on the stem ; but here the plants do not form heads, and only the lower leaves are picked for use as required. The club-root disease to which all the Cabbage family (Cruciferæ) are liable, is the greatest drawback to Cabbage cultivation in the hill districts of Ceylon. (See *Fungus Diseases*). The spores readily infest the soil after the first crop of Cabbages is grown, and a change of soil for each successive crop is advisable if not essential. The only preventive that can be employed is fresh unslaked lime, applied at the rate of about 75 bushels per acre, or 15 lb. to 100 sq. feet. All diseased plants should be burnt. Wire-worms are also a very troublesome pest of Cabbages, and seem to be attracted by the club-root disease.

VARIETIES.—"Sutton's Earliest," "Sutton's Maincrop," and "Early Battersea," are among the best.

Cabbage, Red. (*Brassica oleracea capitata rubra.* N. O. Cruciferæ).—This will thrive well at 4,000 to 6,000 ft., but is not much grown in Ceylon. It is used chiefly for pickling. Cultural

requirements are similar to those of the Cabbage. The principal varieties are "Red Drumhead," "Red Dutch," and "Dwarf Red."

Cabbage, Savoy. A dwarf variety of Cabbage with crimpled leaves. Thrives well at high elevations, but is not much grown in Ceylon nor apparently in India.

Cabbage, Shantung. (*Brassica chinensis.* N. O. Cruciferæ), also known as "Choude Chine" and "Pe-tsai."—A species of Cabbage, shaped like a Cos-lettuce, and weighing, it is said, when well-grown 5 to 6 lb. This has long been in high repute in China as a vegetable. Mr. Hughes, late Commissioner of Customs at Chefoo, stated: "When boiled it is nearly as good as Sea-kale; eaten raw, in a salad, it is of so delicate a flavour that I know of no vegetable in England to approach it." A sample of this Cabbage grown at Kew Gardens was pronounced to be excellent. Mr. W. Nock reported the plant to grow remarkably well at Hakgala Gardens, stating: "In appearance and habit of growth it resembles a gigantic Cos-lettuce; it is bright pea-green in colour, and when cooked possesses a very agreeable and delicate flavour. It has also the advantages of standing the rains well, and growing quickly to a size ready for use. The succulent stalks of the leaves can be eaten like Sea-kale. Taken altogether, it may be considered a valuable addition to the list of vegetables suited for up-country." The Shantung Cabbage thrives best in moist rich soil. It is grown from seed, and the seedlings are planted in rows about 18 in. apart, with the same distance between the plants in the rows. When nearly full grown, the heads should be tied round so as to give them a good white heart.

Capsicum.—See *Tropical Vegetables.*

Cardoon. (*Cynara Cardunculus.* N. O. Compositæ.).—A perennial plant, much relished on the continent of Europe for the sake of the fleshy mid-ribs, but not much appreciated in England. I have nowhere seen this grown in Ceylon, and its cultivation in India also seems to be uncommon. Seedlings may be raised under cover, and planted out in trenches about 3 to 4 ft. apart, with a distance of 18 in. between the plants in the rows. Later on, the earth is drawn up to the plants, as in Celery cultivation, for the purpose of blanching the leaves.

Carrots. (*Daucus carota.* N. O. Umbelliferæ).—This popular vegetable can be grown very successfully at elevations of 4,000 to 6,000 ft. or higher in Ceylon, and also with some success at lower elevations. In up-country market gardens, which supply

at all seasons the low-country markets and the shipping at Colombo, carrots are among the best grown vegetables. A loose, rich, sandy soil, which has been manured well for the preceding crop (no fresh manure should be applied), is the most suitable for the crop. The seeds should be sown thinly in drills about 8 in. apart, the young plants being afterwards thinned out to a distance of 2 or 3 in. apart. Further thinning out may be continued by drawing for use the largest or most crowded plants. The best way of storing carrots is to cover them in a heap of sand in an open shed.

VARIETIES.—These are divided into two distinct classes, viz., the Long-rooted type, which comprises the "Altringham," "James' Intermediate," "White Belgian," etc.; and the Short-rooted or Horn kind, including "Scarlet Dutch Horn," "Early Short Horn," etc.

Cauliflower; "Mal-goa" S. (*Brassica oleracea Botrytis.* N. O. Cruciferæ).—This delicious vegetable is a variety of Cabbage, the dense white flower-heads being the part used. The Cauliflower thrives well at elevations of 5,000 to 6,000 ft., and a rich heavily-manured soil suits it best. Plants from acclimatised seed are said to do best in Bengal, such seed being produced chiefly in Northern India. Cultural directions the same as for Cabbage.

VARIETIES.—Among the best are "Veitch's Autumn-Giant," "Walchereen," "Dean's Early Snowball," and "Large Asiatic."

Celeriac; Turnip-rooted, or Knob-celery. (*Apium graveolens rapaceum.* N. O. Umbelliferæ).—A variety of Celery, the stem of which forms an irregular knob, which is used in salads, while the leaves are used for flavouring purposes. It can be grown from 2,000 ft. upwards, but there is little to recommend its cultivation where Celery can be successfully grown.

Celery; "Seldry" S. (*Apium graveolens.* N. O. Umbelliferæ).—This can be grown with great success in up-country gardens in Ceylon. In the low-country also, very fair stalks can be produced, and the plant is well worth growing even for the sake of the leaves for flavouring purposes. The essential conditions for Celery culture are moisture and rich, well-manured soil. The small seed should be sown in a pan or box under cover, the seedlings being afterwards pricked out into beds or boxes; when about 4 in. high, plant these out about 6 to 8 in. apart in a deep trench, having filled the bottom of which to a depth of 10 in. with manure well-mixed with the soil. The most suitable fertilisers for Celery are considered to be superphosphate and sulphate of potash.

Blanching of the stems or leaf-stalks is encouraged by growing them in darkness. The usual method of effecting this is to draw up the soil to the plants at intervals as they grow, the leaves being meantime loosely tied or held together by means of boards placed temporarily against them. A good method of earthing up Celery for blanching is to take a piece of large bamboo 18 in. long, and slit it in two; having pointed the ends, drive these into the earth, one close on either side of the plant; the latter thus encompassed by the bamboo is earthed up, the bamboo being afterwards removed. Celery takes about 4 to 5 months from the time of sowing to be ready for use.

CELERY. *Apium graveolens.*

VARIETIES.—Amongst the best are "Wright's Giant Grove," "Cole's Solid Red," "Golden Yellow," and "Mammoth White."

Cho-cho; Cayote, or Chayote. (*Sechium edule.* N. O. Cucurbitaceæ).—A perennial robust creeper, with leaves like those of the Cucumber, native of the West Indies, whence it was introduced to Hakgala Gardens, Ceylon, in 1884. It is said to be much grown at the higher elevations in the West Indies, South America, and also in the Mediterranean region, being known in the latter country by the name "Chayote." The plant has become thoroughly established in Ceylon, especially in the hill districts, and thrives from 1,500 ft. upwards. It is propagated by the fruit which is one-seeded, and this must be planted *in situ*, in mounds of well-manured soil. It requires natural or artificial supports for the vines to grow over, and thrives up-country without shade, but is benefited by light shade at lower elevations. The pear-shaped, pale-green

fruits are used like vegetable-marrow, and are in season almost throughout the year, the plants commencing to bear in 3 months after planting. Well grown fruits weigh from 2½ lb. to 3½ lb. each, and these are sold in the local markets and boutiques at 1½ to 3 cts. each. The plant produces under-ground a large yam (tuber) which is much relished by the Natives as a vegetable. In Mexico, this is boiled and candied, the larger yams being sliced and fried for table use. There is also a white-fruited variety, which seems better adapted for the low-country than the ordinary green form. Superstitious belief exists amongst the Natives in certain low-country districts that eating the Cho-cho causes rheumatism, and this no doubt acts as a check on the cultivation of this useful vegetable.

Cress, Garden. (*Lepidium sativum.* N. O. Cruciferæ).—A small annual, commonly cultivated in temperate countries for the sake of the young leaves, which are used in salads. It is a very quick-growing and short-lived plant, being ready to cut for use within a few days after sowing. Seed may be sown broadcast in boxes or beds, which should be shaded from the sun. Frequent sowings are necessary in order to keep up a succession of crops.

Cress, Indian. (*Tropæolum spp.* N. O. Geraniaceæ).—The flowers as well as the young leaves of several varieties of the annual Tropæolum are by some people much relished in salads. The plants are readily grown from seed and thrive at 3,000 to 6,000 ft. elevation; they are also very ornamental, especially the climbing varieties, which are excellent for covering trellis-work, fences, etc.

Cress, Water. "Kakkutu-pala," or "Wataressa" *S.* (*Nasturtium offincinale.* N. O. Cruciferæ).—A low perennial herb, native of Europe, etc., and naturalised in Ceylon, being commonly met with in swampy situations and in the neighbourhood of rice fields at medium elevations. The young leaves form a favourite salad, but do not appear to be much relished by the Natives. Water-cress may be readily propagated from seed, or by cuttings or division of the old plants, and is easily grown in a patch of soil through which water is made to flow; stagnant pools are unsuitable for it. In New Zealand, where the plant has been introduced, it has become practically a scourge, having established itself in almost every water course and spring.

Cucumber. "Rata-kekiri" *S.* (*Cucumis sativus.* N. O. Cucumbitaceæ).—The superior varieties of cucumber, cultivated to such

perfection in temperate countries, can only be grown with success in the tropics where a green-house or a good heating frame is available. Such protection is necessary in order to enable equable conditions of temperature and moisture being maintained. The hardier "Ridge" cucumbers may, however, be grown in the open, in the same way as Pumpkins or Vegetable-marrow. Mr. W. Nock has grown very fair cucumbers in frames at Hakgala Gardens, but market gardeners around Nuwara Eliya seldom attempt the cultivation of these. Seeds should be sown in pots or boxes under cover, and the seedlings planted out, when large enough, where they are to grow. A grateful substitute for the "English" Cucumber is found in the native "Pipingha" (see under *Tropical Vegetables*).

KOHL-RABI. "SUTTON'S EARLIEST WHITE."

Endive. (*Cichorium endivia*. N. O. Compositæ).—An annual of Northern China, cultivated for its stocky head of curly leaves, which when tender are used as a salad and in other preparations. The plant is of easy culture, and may be seen occasionally in up-country gardens in Ceylon. Propagated from seed.

Knol-Kohl, or Kohl-rabi. (*Brassica caulo-rapa*. N. O. Cruciferæ).—This useful vegetable holds a place intermediate between

the Cabbage and the Turnip, and is supposed to combine the flavour of both. The stem above ground widens into a turnip-like head and is the part used. The plant is often erroneously referred to as the turnip-rooted Cabbage, which is a different plant, the tuberous root of which is used. Knol-Kohl thrives remarkably well in the low-country, being able to resist heat and drought better than any other vegetable of the Cabbage family. Seed should be sown in drills about a foot apart, the plants being

LEEKS. *Allium porrum.*

afterwards thinned out to a distance of 8 or 9 in. in the row ; or seedlings may be raised in boxes or sheltered beds, and transplanted as Cabbage. The best time for sowing is at the commencement of the monsoon rains. There are several *green* and *purple* varieties, the green sorts being by some people considered the best.

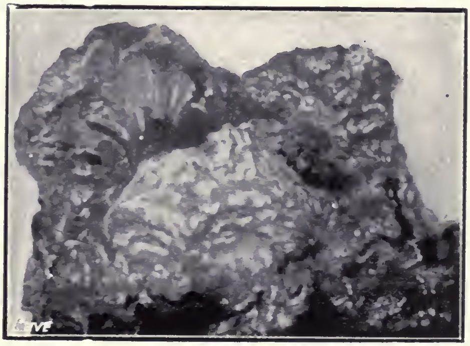
Leek. (*Allium Porrum.* N. O. Liliaceæ).—This thrives to perfection at the higher elevations, but its cultivation is not worth attempting below 2,000 feet. Sow seeds on sheltered beds or in

boxes, before the commencement of either of the monsoons ; prick out the seedlings when large enough to handle, and transplant these at intervals of 6 inches into well-manured, deep trenches. As the plants increase in height, the trench should be filled in gradually with earth so as to encourage the production of a thick succulent and well blanched stem, which is the part used. Leeks require rich loose soil and constant moisture. The "London Flag" and "Musselburgh" are old favourite varieties, which are still perhaps unsurpassed for quality.

Lettuce. "Salada" S. (*Lactuca sativa.* N. O. Compositæ).—This takes first place as a salad plant, and fortunately can be grown at almost all elevations in the tropics, but to greatest perfection in the hills. The plant is an annual, prefers a rich mellow, humous soil, and responds well to manuring. Sowings should be made at intervals of three weeks or a month, so as to keep up a succession of crops. It is best to sow the seed in shallow drills on a well-prepared bed, afterwards thinning out the plants to about 6 or 8 inches apart ; or the seed may be sown in seed-pans or boxes, and the seedlings transplanted out when they have obtained their second pair of leaves, though it is well to remember that Lettuce does not always take well to transplanting. In the tropics, the plants soon run into seed. I am informed that a method adopted in Madagascar to prevent them from seeding is to cut the tap-root below the surface of the soil, this also being considered to have the effect of causing the plants to form a good heart.

COS LETTUCE.

VARIETIES.—These are divided into two classes, viz. "Cabbage-lettuce" (so-called from the round cabbage-like heads with broad leaves), and "Cos-lettuce," the latter being distinguished by erect conical heads and narrow pointed leaves. The former is considered the better kind for wet climates. Of both these there are numerous sub-varieties, as "White Dutch," "Golden Queen," "Little Gem," "White Silesion," "Green Paris," etc.



CABBAGE LETTUCE.

Maize.—See under *Tropical Vegetables*.

Mushrooms. (*Agaricus campestris.* Agarici).—In Ceylon the vernacular names "Bim-mal" (Sinhalese) and "Kalang" (Tamil) are applied to all fungi. While many of the Ceylon fungi, whether growing naturally on the soil or on decayed tree trunks, etc., are edible, others are undoubtedly very poisonous. It is not always easy, especially for inexperienced persons, to distinguish the former from the latter class, though some people consider that they can always do so. The best forms of fungi are those which, when young, are like round white buttons ; when a day or two old they open out like an umbrella, and the gills (underside) are found to be of a delicate pink colour. Poisonous kinds, though somewhat resembling these characters, are said to turn to a bright yellow colour when cooked. Fungi which have a slimy skin, or which when broken or bruised show an intense blue colour, should be avoided. MR. PETCH, the Government Mycologist for Ceylon, prefers not to lay down any hard and fast rule by which a novice may attempt to identify an edible from a poisonous fungus, and considers that "actual experience is the only test." Nor does MR. PETCH attach much importance to the nutritive value of edible fungi generally, an opinion shared by many other botanists. English mushrooms are, however, a popular article of diet with many people, and are commonly imported in hermetically sealed tins for consumption.

For persons who wish to grow their own mushrooms, the following hints may be useful Any room or cellar in an unused

building or out-house, which admits but little light, will answer the purpose of a mushroom house. Excessively wet or dry atmosphere must be avoided, and a high temperature is unsuitable. Horse-dung, being freed from grass or straw, should be collected daily and kept under cover until a sufficient quantity has been secured. It should be spread evenly over the floor to prevent premature fermentation. A bed should be made about 3 feet deep, consisting of alternate layers of the prepared horse dung and good friable soil, finishing with a layer of the latter on top. The whole being beaten down firmly, the bed should be allowed to settle and ferment for about a week. Small cubes, about an inch square, of the mushroom spawn are then planted on the surface, about 6 in. apart and an inch deep. Water the whole thoroughly and, if the weather be dry, sprinkle the surface of the bed every morning and evening with water. A crop of mushrooms may be expected in five weeks to two months from date of spawning, and the beds should remain productive for at least 2 months. Mushroom spawn in brick form may be imported from nurserymen. In the tropics it should be stored away in an air-tight tin until required for planting. Imported spawn in this form is usually prepared from the mycelium of *Agaricus campestris*, the common field mushroom of England, which is not indigenous to Ceylon, and can only be cultivated successfully in the hill districts.

Oca-quina, Melluco, or Ulluco. (*Ullucus tuberosus.* N. O. Basellaceæ).—This plant is a native of Peru, where it is cultivated for its tubers, which are said to be largely consumed like potatoes. It was introduced as small tubers at Hakgala Gardens, Ceylon, in 1885, when the late Superintendent reported that it grew rapidly, the tops dying down in November. The tubers produced were reported to be from 2 to 3½ inches long, and shaped like a kidney potato. Usually, however, they are of the size of Hazel-nuts. The plants trail over the surface of the ground, rooting and producing small tubers at each node. If planted in good soil they will mature a crop in about five months from date of planting. The plant is suited to up-country only, and Mr. W. Nock stated it was best to plant the tubers in April, in rows about 18 inches apart. Thus treated, he found that "one plant produced as many as 636 tubers, weighing in all 6 lb."

Onion; "Lunu" *S.* (*Allium cepa.* N. O. Liliaceæ).—Onions thrive moderately well in up-country gardens in Ceylon, and with careful cultivation occasionally attain fair success at intermediate

elevations. A dry rather than wet climate suits them, and the best crops are produced in moderately-dry districts, as at Wilson Bungalow. The Onion requires a light soil, which should be enriched with well-decomposed manure. The seed may be sown broad-cast on raised beds, or in shallow drills about 8 inches apart; after sowing, cover the seed lightly with a sprinkling of finely-sifted soil, and beat the surface of the soil gently with the back of a spade or a flat piece of board. Or the seed may be sown in pans or boxes, and the seedlings transplanted out when strong enough into well-prepared beds. The plants should not be closer than 5 to 6 inches each way, while they should be as near the surface as possible so as to encourage the bulbs to increase in size.

VARIETIES.—"Ailsa Craig," "Blood-red," "Sutton's A1," "Tripoli," and "Veitch's Main Crop" are leading sorts. In India, acclimatised varieties such as "Silver-skin" or "Patna-onion," and the large "Red Onion" are recommended for the plains.

Onion, Egyptian.—This produces on the flower-stalks bulbils of the size of marbles, which are excellent for pickling. Offset bulbs are also formed underground, and propagation is effected by both forms of bulbils. Not cultivated in Ceylon.

Onion, Potato.—This is propagated by offsets produced underground, which are comparatively small in size and irregular in shape. The bulbs are planted singly, and around these new ones are formed. This variety is not propagated by seed.

Onion, Welsh. (*Allium fistulosum*).—This affords the popular "Spring onions" of temperate countries. The plant is quite distinct from the common onion; no bulb is formed, the young tender stem being the part used.

Onions, "Small."—See *Shallots.*

Oxalis crenata.—See *Tropical Vegetables and Food Products.*

Parsley. See under *Condiments, Seasoning and Pot-herbs.*

Parsnips. (*Pastinaca sativa.* N. O. Umbelliferæ).—This excellent vegetable can be grown most successfully in up-country gardens, especially in sheltered and moist situations with loose, deep and rich soil. It does not thrive at elevations below 4,000 ft. Its cultural requirements are similar to those of Carrots, but the plant needs greater space than the latter. Seed is best sown in drills about 15 or 18 in. apart, the plants being thinned out when a few inches high to distances of 10 or 12 inches in the row. Medium-sized roots are preferred to very large ones, which are liable to be bad at the core.

Peas. "Bola-kadala" *S.* (*Pisum sativum.* N. O. Leguminosæ).—Peas of very fair quality can be grown in the hill districts, and at lower elevations also appreciable crops may be obtained if seed be sown at the proper season and in well-manured soil. In India, acclimatised seed is often preferred to imported seed for sowing on the plains. A variety of Peas imported from India as a food-stuff, which may be obtained from boutiques in Ceylon, will, if sown, often give a better crop in the low-country than English Peas. It grows to a height of about 3 feet, and bears small but well-filled pods, with small round grey seeds. For up-country, however, none but imported seed from temperate countries should be sown. A wet season is unsuited to the crop and, in order to avoid this, the best time for sowing the seed is before the end of the monsoon rains, i.e., approximately (for Ceylon) July to August, and November to December. The ground should be well-manured, and the seed sown evenly (about 2 in. apart) in uniform drills, being covered with about an inch of soil. If the weather be dry, water the ground after sowing the seed. As the plants grow, fill in the earth occasionally along both sides of the row, and when they are about 4 or 5 inches high place twigs and branches along either side for support to the plants. An application of 1 lb. of nitrate of soda per 40 square yards when the plants are well above ground will give them a good start. The distance between the rows may be about 2 ft. for dwarf varieties, and 4 ft. for larger kinds. Where ground has to be economised the rows may be several feet apart, and the intervening space cultivated with smaller crops.

VARIETIES.—The number of these is legion, many of which differ but little, if any, from each other. The following are distinct and of first-rate quality: "Sutton's Excelsior" (about 18 in. high), "Sutton's Green Gem" (15 in.), "Veitch's Acme" (3 ft.), "Sutton's Ideal" (3 ft.), "Yorkshire Hero" (2 ft.), and "Captain Cuttle" (4 ft.). The dwarfer varieties are the most suitable for dry districts.

Potato. "Arthapel" *S.* (*Solanum tuberosum.* N. O. Solanaceæ).—Although very fair crops of certain varieties of potatoes can be grown in the neighbourhood of Nuwara Eliya, especially in the drier districts of Uda-pussellawa and Wilson Bungalow, the quality of the tuber is seldom comparable to the best potato grown in temperate countries. Yet many people prefer the new-grown potato to the usually dried-up imported article obtainable at the local stores or markets. The best soil for potatoes is a light friable loam, preferably on a slope, as good drainage is essential.

The ground must be manured, but not too heavily, as that, it is considered, may conduce to disease. The following manure mixture is recommended: 5 lb. superphosphate, 2 lb. sulphate of ammonia, 3 lb. kainit; apply 3 oz. of the mixture per yard of each row. The best time for planting varies according to district, but usually from September to November, and March to May will be found the most satisfactory periods for planting in Ceylon. It is, of course, needless to attempt growing potatoes successfully under 4,000 ft. elevation. New potatoes may be expected to be fit for consumption in about 3 months from the time of planting.

A FINE POTATO FIELD, ALBION ESTATE, CEYLON.

Propagation is effected by means of "sets" (tubers), these being planted 3 or 4 in. below the surface at distances of about 9 in. in rows, the latter being about 18 in. apart. Needless perhaps to say, a crop should not be grown for successive seasons in the same ground. The larvæ of the potato-moth, which has been imported into India with seed potatoes, have become a troublesome pest there, and seed potatoes arriving here from India have consequently to be treated in the fumigatorium at Colombo.

VARIETIES.—The following have been found among the most successful in the neighbourhood of Nuwara Eliya: "Sutton's Abundance," "Satisfaction," "Ringleader," "Nonsuch," and "Ideal."

Radish. "Rabu" S. (*Raphanus sativus* N. O. Cruciferæ).—Radishes can easily be grown at all elevations. The seed, if sown broadcast on the smooth surface of a bed, will germinate in two or three days, and the radishes are ready for use in about three weeks to a month afterwards. Sowings should therefore be made at frequent intervals to keep up a succession. Radishes do best in a partially shaded situation which can be kept moist. The young plants should at first be thinned out to 2 or 3 inches apart, further thinning being effected by taking up the largest as these become fit for use. There are numerous varieties, which differ mainly in the shape of the succulent root, this varying between long, turnip-rooted, and oval-rooted. "Cabbage-radish" is a name that may appropriately be given to a large perennial variety which has been introduced from India, and may occasionally be found cultivated in low-country gardens in Ceylon. The root of this is not eaten, but the large outer leaves are used as a vegetable by the Natives, being picked as required.

Rhubarb. (*Rheum rhaphonticum.* N. O. Polygonaceæ).—This delicious and wholesome vegetable can be grown with much success in hill gardens, but is quite unsuited to low or even intermediate elevations. The use of the succulent leaf-stalks for tarts, stewing, etc., is of comparatively modern date. Formerly the leaves only were used as a pot-herb, like spinach. Rhubarb thrives best in rich deep, but rather light soil, and prefers a shady situation. It is usually propagated by division of the roots or crowns, but may also be raised from seed.

Salsify. "Oyster Plant." (*Tragopogon porrifolius* N. O. Compositæ).—This vegetable is of easy cultivation up-country, except during the heavy south-west monsoon rains, and is commonly grown in the neighbourhood of Nuwara Eliya for market purposes. The root, which is not unlike a thin parsnip, is the part eaten ; it is about the thickness of a man's fore-finger, 9 inches long, and is fit for use in 3 to 4 months from the time of sowing the seed. The plant thrives on a rich sandy soil. Seed may be sown in drills, after the heavy rains are over, the seedlings being afterwards thinned out to about 4 in. apart. The flavour of the roots has a fancied resemblance to that of an oyster. There are various ways of preparing the roots for the table ; they may be parboiled, cut into large pieces and fried in butter ; or they may be boiled, then grated and made into cakes to be fried with butter.

Scorzonera. "Viper's Grass." (*Scorzonera hispanica.* N. O. Compositæ).—A herbaceous perennial, native of Europe, similar to Salsify, but differing from it in having broader leaves and black-skinned roots. The latter are the part used, and these are considered by some to be superior to Salsify. The same cultural conditions as recommended for the latter plant will suit Scorzonera; but the roots take longer than those of Salsify to become ready for use. The plant is seldom grown in Ceylon.

Scorzonera deliciosa.—A species characterized by a sweeter flavour than the preceding one, extensively cultivated as a vegetable in Sicily, etc.

Sea Kale. (*Crambe maritima.* N. O. Cruciferæ).—This vegetable, the young blanched and crisp shoots of which are used, is not grown in Ceylon, where the climatic conditions even at the higher elevations are not suited to it. Neither does it appear to be grown on the hills in India.

Shallots. (*Allium ascalonicum.* N. O. Liliaceæ),—A small bulbous perennial, grown for its bulbs, which are used for flavouring purposes, much in the same way as garlic; the bulbs do not however possess so strong an odour or flavour as the latter. Shallots are imported into Ceylon from Bombay, and sold in almost every bazaar or boutique, being commonly known as "small onions" and largely used for curries, pickling, etc. They may be grown successfully especially in a rather dry climate, at medium elevations, in light rich soil, and respond to an application of kainit, nitrate of soda, or superphosphate. They may be planted in drills about 8 in. apart, with a space of 6 in. separating the bulbs in the drill. Plants may also be raised from seed.

Solanum Commersoni. (N. O. Solanaceæ).—A new tuber vegetable, allied to the common Potato, and recently introduced from Uruguay. This has been experimented upon in England at the instance of the Board of Agriculture, and the results have been reported as promising, the plant being "likely to become a useful edible tuber, yielding heavily and being entirely resistant to disease." It is further stated that the plant "appears very susceptible to cultivation, and rapidly improves when grown in fertile soils." In 1902 a yield of about 6½ tons per acre is reported to have been obtained in England on a fertile soil, but without any manuring or cultivation beyond a single hoeing when the shoots first appeared. The plant is considered best suited to wet soils. A violet-coloured

variety which has been introduced to Hakgala Gardens in 1909, resembles externally the common Potato; it is claimed for it to be more prolific than the latter, but this has not been verified by results in Ceylon.

Spinach, English. (*Spinacea oleracea.* N. O. Chenopodiaceæ). —A stemless annual, native of Northern Asia and cultivated in cool countries for the sake of its soft edible leaves, which when cooked and dressed are an agreeable vegetable. Spinach is seldom seen in up-country gardens, where, however, it should thrive well during the fine weather season. As it takes up but little room and is soon ready for cutting, it is adapted for growing between slower-growing crops. Seed may be sown in November, in drills about a foot apart, the plants being afterwards thinned out as may be necessary. Spinach loves a rich soil, a shady situation, and liberal watering in dry weather.

Sorrel. (*Rumex Acetosa.* N. O. Polygonaceæ).—A perennial, native of Europe, sometimes grown for its acid leaves, which are either used as an ingredient in salads, or boiled and used as Spinach. Sorrel is not suited to low elevations, but will thrive in hill gardens. It is propagated from seed, and prefers a shady situation. Sow seed in drills one foot apart, and thin out the plants afterwards as may be required.

Spinach, New Zealand. (*Tetragonia expansa.* N. O. Chenopodiaceæ).—A tall annual, native of New Zealand, the leaves of which are used in the same manner as English spinach. It is coarser than the latter, and has rather hairy glaucous leaves; it is of easy culture, and grows luxuriantly in hill gardens in Ceylon, where it has become semi-naturalised in places. Seed may be sown in drills, about 18 inches apart, the seedlings being afterwards thinned out as required.

Tomato; "Takkali" *S*; "Takkali-kai" *T.* (*Solanum lycopersicum*, N. O. Solanaceæ).—An annual, native of South America, commonly grown in most countries for its fruit, which are esteemed in salads, and for making sauces, flavouring soups, etc. The fruits of superior varieties, when well-grown, are also used for dessert. Tomatoes can be grown with much success in the tropics, especially in rather dry districts, at medium elevations. They do best in rich and well-drained soil, and should not be grown for more than one season consecutively in the same ground. The seed should be sown in pots or boxes, the seedlings being afterwards planted out when strong enough

into pots, tubs, or on a sheltered border. Supports for the plants are essential, and this may be provided in the form of firm stakes, a fence, or low trellises. If the fruits fail to ripen on the plants in wet weather, they may be picked green and kept in a dry sunny place for a few days, as this will considerably advance their ripening. The plants should be regularly pruned, superfluous growth being cut out, shoots pinched back or removed, and the leaves reduced so as to admit light to the fruit. In Ceylon, tomatoes are grown for market chiefly in the rather dry district of Dumbara, and the plants are generally raised from seed grown locally ; but the fruits do not usually bear comparison in size or flavour with the best seen in temperate countries. Occasionally, however, very fair fruits may be obtained up-country during the dry season. Seedlings should be raised under cover, and planted out about 4 ft. apart in mounds or ridges. A well-drained, rich porous soil is essential. Superphosphate is especially suitable as a fertiliser, being productive of fruitfulness. After the setting of the fruit nitrogenous manures may be applied.

VARIETIES.—The "Conqueror," "Sutton's Peach Bloom," "Sutton's Perfection," and "Hathway's Excelsior" are all good. The "Cherry" and "Red Currant" varieties bear numerous small fruits in clusters, and are very ornamental.

Turnip. (*Brassica rapa* N. O. Cruciferæ).—Turnips of very good quality can be grown at the higher elevations in the tropics. In the hill districts they are regularly grown for home consumption or for market purposes, the best crops being obtained in the drier season. At medium elevations of 2,000 to 4,000 ft. very fair roots may be obtained in the cool season. Turnips thrive best on soils of a light sandy nature, which must be enriched with well decomposed manure ; stiff retentive soils are ill-adapted for them. Seed may be sown broadcast on well prepared beds, or in shallow drills about 14 to 16 in. apart, the seedlings being thinned out when 2 or 3 in. high, leaving a space of about 5 in. between them ; further thinning can be effected by picking the largest turnips for use as required. The best time for sowing is before the end of each monsoon.

VARIETIES.—Amongst the best are "Early Snowball," "Early White Dutch," "Veitch's Red Globe," and "Scarlet Perfection." On the plains of India, acclimatised varieties are said to give the best results.

Udo or Oudo. (*Aralia cordata.* N. O. Araliaceæ).—A shrubby perennial with large compound leaves, attaining a height of 5 to 6 ft. The young and blanched stalks, which are from

10 to 16 in. long, are eaten as a salad vegetable in Japan, where the plant is said to be extensively cultivated for the purpose of supplying these. It is stated that the cultivation of this plant forms an important feature of market-gardening in Japan.

Vegetable Marrow. (*Cucurbito pepo.* N. O. Cucurbitaceæ).—This agreeable vegetable is commonly grown, and with much success, in the hill districts, but is unsuited to elevations below 4,000 ft. The plant grows rapidly and trails over the surface of the ground, producing its large gourd-like oblong fruits, which are most palatable if cooked before they have attained full size. The seed may be sown singly in a pot, the stronger seedlings being afterwards retained and, when a few inches high, transplanted to well-prepared mounds or small hillocks not less than 6 feet apart each way. These mounds should have good drainage, and consist of well manured soil. The plant is monœcious, i.e., the sexes are in separate flowers on the same plant ; the female flowers must therefore be fertilised either by insects or by hand, with the pollen of the male flowers, otherwise fruit will not set. The female flowers can at once be distinguished by their large and round base (the ovary), and also by their having no pollen.

CHAPTER XIV.

SPICES, CONDIMENTS, AND SEASONING HERBS.

SPICES OF THE TROPICS:

[*S*=SINHALESE; *T*=TAMIL].

From remote ages the spices of the tropics have attracted traders from distant lands and formed a lure for adventurous explorers. More especially can this be said of the spices of southern Asia, as the cinnamon of Ceylon, nutmegs and cloves of the Moluccas, cardamoms, ginger and pepper of southern India. Some of the ancient cities of Europe are said to have been indebted for a large share of their wealth to the trade in tropical spices during the time of the Romans. Cinnamon, which has long been associated with the "spicy breezes" of Ceylon, was from the earliest times perhaps the most coveted of all spices. It is mentioned in the Songs of Solomon and in the Book of Proverbs; the Arabians supplied it to the Greeks and Romans, but jealously shrouded in mystery the sources of its origin and the manner of obtaining it. It is supposed that the spice, being first brought from Ceylon to the western coast of India, was carried thence to Arabia and Egypt by African and Arabian traders, finally reaching Europe after a journey of very many months. Cinnamon was for a long period a State monopoly in Ceylon, and its cultivation was not declared free until 1833. At one time, it is said, cinnamon was sold in London for £8 per lb., pepper at 10*s.* a lb., while other spices commanded similar fabulous prices. As recently as 1880, cardamoms were sold for over 9*s.* a lb. In 1826 the English import duty alone on pepper was 2*s.* 6*d.* a pound, on cinnamon about 3*s.* a pound, on nutmegs and mace 3*s.* 6*d.* a pound each, on cloves 5*s.* 7½*d.*, while vanilla was taxed to the extent of nearly 17*s.* per lb.

DISTRIBUTION OF SPICES

For a long period the uncultivated or wild trees of the forests furnished the world's supply of spices, which consequently was confined to the natural habitat of spice-yielding plants. The spread

and cultivation of these was for a long time retarded by the system of State monopoly established by the Dutch in the principal spice-producing countries. So severe, for instance, was the Dutch law in regard to cinnamon in Ceylon that the offence of cultivating a cinnamon tree on private land or destroying one belonging to Government was punishable by death. Cloves and nutmegs in the Moluccas were similarly guarded by the Dutch, the plants being either deliberately destroyed, or their cultivation enforced to suit the circumstances. An amusing story told in this connection is to the effect that the Home Dutch Government, being ignorant of the fact that both nutmegs and mace were produced by the same tree, once despatched orders to their Colonial Governor requesting him to *reduce the number of Nutmeg trees*, but to *increase the cultivation of Mace trees.* But even nowadays it is not generally known that both spices are the product of one tree. It is common knowledge that the Dutch deliberately exterminated the clove and nutmeg trees in certain islands of the Moluccas, in their endeavour to secure the monopoly of the spices, while confining the cultivation of these to Banda and Amboyna. Notwithstanding the severe restrictions of the Dutch, however, the escape of the precious spice plants to other countries was gradually effected, both by smuggling and by the agency of migrating birds. Thus, it is recorded, a species of wild pigeon extracted the nutmeg from its pulpy covering, digested the mace, and voided the seed uninjured. The French succeeded in 1770 in introducing the Clove tree into Mauritius and Reunion, from whence it soon reached Zanzibar, etc. A striking result of this is that the world's greatest supply of cloves now comes from the latter island, and not from the native home of the tree, the Moluccas. Similarly Jamaica obtained the Ginger plant from India, and has long practically commanded the supply of that spice; while the same may be said of Reunion and Seychelles in regard to the production of vanilla, whose native home is South America.

IMPORTANCE OF SPICES

Spices form one of the most important classes of vegetable products. They possess valuable medicinal properties, and their presence renders agreeable articles of food which are otherwise unpalatable. When used judiciously in cooking, spices aid the digestion by their effect in increasing the secretion of the gastric fluids; to the confectioner they are particularly essential, and are used largely for his purpose, more especially on the Continent of Europe; while in the preparation of superior beverages they are

also important. In pharmacy certain spices, especially ginger, cardamoms and cloves, hold a very important place, both on account of their medicinal properties and their effect in disguising nauseous decoctions. The antiseptic properties of spices, more especially cloves, due to their volatile oils, is well known, and for preservative purposes, both in domestic and scientific uses, they are invaluable. The appropriateness of spices to sacred uses, as for burning in incense, has long been recognised, and in certain social and religious customs of oriental countries spices are to this day very commonly employed. It is recorded that spices were used in the funeral piles of the Egyptian Kings and that Nero burnt at the obsequies of his wife "a quantity of cinnamon and cassia exceeding in amount the whole importation into Rome for one year!" Finally, not the least virtue of certain spices is their effect in sweetening the breath of persons who are addicted to masticating habits, popularly known in the East as "betel-chewing." For this purpose cardamoms especially are esteemed in India and Ceylon, and star-anise in China and Japan. It is claimed that spice trees also have a beneficial effect on climate, their volatile oils acting as a preventive against mosquitoes and other germ-carrying insects.

The following are the principal spices of the tropics in alphabetical order, with a brief description and notes on their cultivation and uses, etc. The botanical name and Natural Order are within brackets.

Allspice; "Whole-spice;" Pimento; "Jamaica Pepper" (*Pimenta officinalis.* Myrtaceæ). A small tree with smooth greyish bark, 25 to 35 feet high, native of the West Indies and Central America. The dried unripe berries, which are of the size of small peas and of a glossy black colour when ripe, are the allspice or pimento of commerce. The name "all-spice" is due to a supposed resemblance of the spice to a combination of the odour and flavour of cinnamon, nutmegs and cloves. The trees had been introduced into Ceylon early in the last century, and established at Peradeniya, where it flowers in the dry weather and usually produces a small crop of fruit, but outside the Botanic Gardens it is rarely met with in this country. It is considered to yield best in a hot and rather dry climate, preferring a loose loamy or alluvial, well-drained soil. The berries are picked while green, but just ripe, and are then dried in the sun, the latter process taking six to ten days. The fruits are known to be sufficiently dry

when they become black in colour and when, on shaking, the seed rattles inside. The process of gathering is effected by a long stick with a crook at the end, the fruit-bearing clusters being

ALLSPICE TREE.—*Pimenta officinalis.*

broken off and thrown down, and the berries then picked off the stalks by women and children. An allspice tree under favourable circumstances begins to bear when 7 or 8 years old, but it is not usually in full bearing until about 18 or 20 years old, when a single

tree may yield as much as 1 cwt. of the dried spice. Jamaica is the only country at present that exports this spice, and its annual export varies from 9 to 10 million pounds or more; the average price realised in the Island is about 15*s.* per 100 lb., though sometimes it is as much as 30 to 40 shillings for the same quantity. The market price in England is about $2\frac{1}{2}d.$ to 3*d.* per lb.

Pimento oil, which is obtained by distillation from Allspice leaves, is imported into London and sold for about 2*s.* 9*d.* to 3*s.* 6*d.* per lb. Added to rum, it forms what is known as bay-rum.

Allspice, Lemon-scented. (*Pimenta citrifolia.* Myrtaceæ).—This distinct spice-tree was introduced from Dominica to Peradeniya in 1888, and has become perfectly established here, being now about 40 feet high and of an erect slender habit; but it has not yet fruited. The leaves upon being bruised emit a delightful lemon-scented odour.

Allspice, Carolina. (*Calycanthus floridus.* Calycanthaceæ).—A hardy shrub of North America, the wood and roots of which are of a spicy nature, and smell strongly of camphor.

Allspice, Japan. (*Chimonanthus fragrans.* Calycanthaceæ).—A shrub with small pale yellow flowers. Suited for high elevations only.

Bay Tree, or "Wild cloves." (*Pimenta acris.* Myrtaceæ).—A small erect West Indian tree, the aromatic leaves of which yield by distillation an oil which is used in the preparation of bay-rum. A return may be obtained in about three years from planting, and on an average 100 lb. of leaves will yield about 16 oz. of oil. It is estimated that the return per acre may be at least 53 lb. of oil, which at 5*s.* per lb. is worth £13. The tree has been established at Peradeniya, and may be seen in the Spice collection there. The dried leaves, obtained mostly from trees growing naturally in the forests, are exported from Dominica and other West Indian Islands to America, etc.

Cardamoms; "Ensal" *S.* (*Elettaria Cardamomum.* Scitamineæ).—A perennial with large leafy shoots, 8 to 15 inches long, and strong creeping root-stock (rhizome), native of the moist forests of Ceylon and Southern India up to 3,000 feet. In cultivation it thrives best at 3,000 to 4,000 feet, and in partial shade. When starting a plantation, sufficient forest trees should be left to provide shade, as well as to afford protection from strong winds. The spice consists of the fruit, or rather the numerous small seeds enclosed in the green ovoid capsule. The fruits are gathered

before being fully ripe, washed free from sand, etc., and then placed in large, light trays supported on trestles, in which they are dried and bleached in the sun. The use of these trays facilitates their removal indoors at night, or their being covered when a shower threatens. In the further bleaching of the capsules, which is usually necessary, the trays with their contents are placed over

MYSORE CARDAMOM. *Elettaria Cardamomum.*
A.—FLOWER AND FRUIT RACEMES. B.—DRIED FRUITS OR CARDAMOMS.

sulphur fumes in a hermetically closed case. 1 lb. of sulphur is thus sufficient for 100 lb. cardamoms, and the latter are left in the sulphur enclosure for an hour, being afterwards exposed to the sun for a few hours. When ready for export, the best capsules are creamy white, smooth and silky. The capsules vary in size and shape, from ½ to ¾ inch long, and from oblong to oval or almost round; they are graded accordingly, the grades being known as

"longs," "mediums," "shorts," etc. Cardamoms are a powerful aromatic and are used chiefly in confectionery, as an ingredient in curry powder, and also in medicine. The seeds are much esteemed by the Natives for use with masticatories, or for sweetening the breath, and sugar-coated cardamoms are much used at Hindoo festivals and ceremonials. The plants are increased by division of the

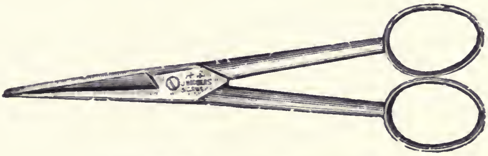
CEYLON WILD CARDAMOM.—*Elettaria Cardamomum, var. majus.*

"bulbs" (rhizomes), or by sowing seed in well-prepared nursery beds. In planting out, two to four "bulbs" or plants are placed in each hole or clump, these being 7 or 8 feet apart each way, say 850 stools to the acre. A small crop may be expected in three years from the time of planting, and from the sixth year a return of 150 to 350 lb. per acre may be obtained, according to cultivation, nature of

CARDAMOM PLANTATION

the soil, etc. Though the plants are in bearing all the year round, the crop being gathered once every fortnight or three weeks, the largest yield is obtained in dry weather and the principal season is during February and March in Ceylon. The fruits should be cut by scissors, not pulled by hand, and they should be gathered when ¾ ripe; if left to ripen, they split open and disperse the seeds. Cardamoms fetch at present from 4*s.* to 5*s.* 6d. per lb. in London. Twenty years ago they were sold for as high as 9*s.* a pound. The total export from Ceylon in 1909 was 821,184 lb. valued at Rs. 797,818, the highest price realised being about 2*s.* 7*d.* per lb. The export fell to 542,650 lb. in 1912, valued at Rs. 820,150, the average price advancing to about 3*s.* 6*d.* or 4*s.* per lb.

DRYING CARDAMOMS.



CARDAMOM PLUCKING SCISSORS.

CLIPPING CARDAMOMS BY MACHINE.

VARIETIES.—"Malabar Cardamom" is distinguished by the leaves being softly pubescent on the under side, and the flower racemes having a tendency to trail near the ground. "Mysore Cardamom" has the leaves glabrous on both sides, and the flower racemes are of a more erect habit. The latter variety is therefore preferred for cultivation, as the fruits, being further from the ground, are not so liable to get damaged as those of the trailing racemes. "Nepal," "Bengal," "Java," "wild or bastard" (of Siam) are forms of cardamoms derived from various species of *Amomum*, which are only of importance in the East. The "Ceylon wild cardamom" bears the largest capsules, sometimes attaining 1½ inches in length.

SULPHURING CARDAMOMS.

Cassia Bark. Cassia Lignea, or Chinese Cassia (*Cinnamomum Cassia*. Lauraceæ).—A small tree 30 to 40 feet high, with long lanceolate brittle leaves, allied to the Cinnamon. The tree is a native of Southern China, and has been introduced in 1882 into Peradeniya, where it is now well established, bearing seed each year in July and August. Cassia has been known from the earliest times as a spice. It is mentioned frequently in the Bible and by early Greek authors, also in Chinese herbals as early as 2700 B. C. The whole tree is pleasantly aromatic and its bark is used as a substitute for the true cinnamon. In its native country it is cultivated for its fruit "buds" or bark, the former being picked by hand, and the bark peeled off and "quilled" much in the same way as cinnamon, and made up in bundles for export. The tree is not grown in stools, so that the bark is obtained, unlike cinnamon, from the branches, which are cut down when the trees are about six years old. The yield per acre is said to be about eleven piculs, (1 picul=133⅓ lb.), which is sold by the producers for about 1½ dollars per picul. In addition to this, however, an important revenue is obtained from the sale and export of the dried unripe fruits, known commercially as "Cassia Buds," which are worth about 80*s*. per cwt. in London. Cassia

oil, which is obtained from the leaves as well as bark, is usually quoted at 3*s*. to 3*s*. 9*d*. per lb. The tree is propagated from seed, and requires similar conditions of soil and climate as Cinnamon.

Chillies, Red pepper, or Capsicums; "Miris" or "Gasmiris" *S*; "Kochika" *T*. (*Capsicums spp.* Solanaceæ).—Small annual or biennial, herbaceous, shrubby plants, cultivated throughout the tropics for the sake of their pungent fruits, which are usually an indispensable spice in the food of people in tropical countries, more especially that of the Natives. The fruits are also used in pickles and sauces, in the manufacture of "Cayenne pepper," and in medicine. The three principal species, of which there are many varieties, are *Capsicum minimum* (Bird pepper, or Guinea-pepper), *C. frutescens* (Goat-, or Spur-pepper), *C. grossum* (Bell-capsicum, or Bull-nose pepper). The last named form is entirely free from the acrid and burning pungency peculiar to the others, and may be eaten cooked as a vegetable or in salads. (See *Tropical vegetables*). Chillies thrive best in loose humous soil, which must be well-tilled, and will grow up to 3,000 feet or more above sea-level. Seeds may be sown in beds or boxes, the seedlings being planted out in well prepared ground when three to four inches high, at distances about two feet apart, or at the rate of 10,800 plants to the acre. A crop is obtained in about eight months from the time of planting, and the yield may be from 1,000 lb. to 1,400 lb. of dried chillies per acre. Chillies sell in London at from 30*s*. to 45*s*. per cwt., the "Nepaul chillies" usually fetching the highest price, these being sometimes sold for £4 per cwt. The product is largely exported from Zanzibar, India, Natal, West Indies, etc.

Cinnamon; "Kurundu" *S*.; "Kuruva" *T*. (*Cinnamomum zeylanicum*. Lauraceæ).—A moderate or large-sized tree, 40 to 60 feet high, with 3-5 nerved alternate leaves, native of the moist low-country of Ceylon and South India. In cultivation, the tree is grown as a bush so as to produce numerous long straight clean shoots, which are cut periodically close to the ground in order to obtain the bark. The bark is first rung by the peelers at distances of about 1½ feet apart, then slit longitudinally and detached; it is piled into heaps to undergo a slight fermentation, a process which facilitates the next operation of removing the cuticle, which is done by scraping with a curved knife. The bark then dries and contracts into quills, the smaller of which are placed inside the larger, forming smooth "canes" about 3 feet long

which, when dry, are of a light yellowish brown colour. These are made up into bales of about 60 to 65 lb. for export. Cutting takes place during the rainy seasons, chiefly during May and June and again in November and December; the shoots selected for cutting are mostly of two years' growth. A return of about 50 to 60 lb. per acre may be expected from the first crop, in the third or fourth year from planting, the yield increasing each year until the eighth or tenth year, when 100 to 150 lb. per acre may be

CINNAMON PLANTATION.

obtained. About $6\frac{1}{2}$ million pounds (including quills and chips) were exported from Ceylon in 1909, valued at Rs. 2,729,637, while in 1912 the figures dropped to 5,945,600 lb., but valued at about Rs. 2,835,000. Cinnamon is now largely used in medicine as well as for flavouring purposes. The price per pound realised at present in London varies from about 1*s.* 6*d.* for *fine quills*, and 2*d.* to 4*d.* for *chips*. The tree may be propagated from seed, cuttings or layers. The method usually adopted is to sow about 25 seeds in a clump, *in situ* or in a nursery, the clumps from the

latter being afterwards planted out entire. The stools are planted out at distances of about 10 ft. apart each way, say 435 to the acre. The best flavoured bark is produced on white sandy soil, below which there is a stratum of mould, provided the rainfall (85 to 100 inches) and temperature (averaging about 80°) are adequate. In Ceylon the tree thrives up to about 2,000 feet. alt. in the moist zone. *Cinnamon Chips* are the small waste pieces resulting from the cutting and peeling operations, and are exported

CLOVE BRANCH

A.—FLOWER BUDS OR GREEN CLOVES. B.—DRIED CLOVES.

chiefly for the distillation of *cinnamon oil.* This latter is also manufactured in Ceylon to some extent, and exported. Cinnamon was the first article of importance exported from Ceylon, and at one time was sold in Europe for fabulous prices. It is exported to some extent from Java, and now from Seychelles, but Ceylon is still by far the most important source.

VARIETIES:—There are several varieties of Cinnamon, the principal ones known in Ceylon being "Penni" or "Rasa-kurundu," "Tittha-kurundu," and "Kahata-kurundu," all Sinhalese names.

Clove; "Karabu" S. (*Eugenia caryophyllata.* Myrtaceæ).—A small conical tree, 30 to 40 feet high, native of the Moluccas, introduced and established in Ceylon before the arrival of the British. The cloves are the dried unexpanded flower-buds. These are picked green, usually during January and February in Ceylon, and being spread in the sun for a few days to dry they become dark brown. The tree likes a rich sandy soil on sloping land, and thrives up to 1,500 feet. It is propagated by seed, which takes five or six weeks to germinate. The seedlings, which

MADAGASCAR CLOVE. *Ravensara aromatica.*

are of very slow growth, may be planted out when 12 or 15 inches high, at distances of about 15 or 20 feet apart. The first crop may be obtained when the trees are 7 to 8 years old, the yield increasing until they are about fifteen or twenty years old, when an average yield of 8 to 10 lb. of dried cloves per tree may be procured. Zanzibar and Pemba furnish at present by far the greater part of the world's supply of cloves, Penang and Amboyna coming next in importance as sources of supply. The present price of cloves in London varies from 8*d.* to 1*s.* 2*d.* per lb., according

to quality and demand. The Ceylon Customs give the export of cloves (with which is included mace) from Ceylon in 1912, as 111 cwt. valued at Rs. 7,125. Zanzibar exported 9,055 tons of cloves in 1912, valued at £330,410.

Madagascar Clove, or Clove-nutmeg. (*Ravensara aromatica.* Lauraceæ).—A medium-sized tree, 30 to 40 feet high, with small leathery leaves, native of Madagascar, introduced at Peradeniya in 1847. The whole tree is strongly aromatic. The round fruits, of the size of marbles, have a large hard kernel, which seems to combine the odour of nutmeg and clove, and is said to be used and esteemed as a spice in its native country, being also exported in small quantities to Europe. The tree is propagated by seed, and is suited to the moist low-country under 1,500 feet altitude.

Brazil Clove. (*Dicypellium caryophyllatum.* Lauraceæ).—A Brazilian tree, the "cloves" of which are said to be remarkable for their fine aroma, being largely employed in their native country for flavouring as well as for medicinal purposes. The bark furnishes what is known as "Clove Cassia."

Ginger; "Inguru" *S.* "Inji" *T.* (*Zingiber officinale.* Scitamineæ).—A herbaceous perennial, with leafy shoots which grow to a height of about 18 inches, native of Tropical Asia, but introduced and cultivated in all tropical countries. The underground tuberous stems (rhizomes), resembling thickened roots, are the ginger of commerce. These are called "hands" or "races," from their palmate shape, and are exported in two forms, *peeled* and *unpeeled* (or uncoated and coated) ginger. The former is prepared by scalding the tubers in boiling water, the epidermis being then removed by a narrow-bladed knife. Unpeeled or coated ginger (*i.e.*, not deprived of the epidermis) is merely washed, and then dried in the sun. The rhizomes are exported in bags or barrels, and sold in London at prices varying from 40*s.* to 80*s.* or more per cwt., according to quality. Japanese and West African ginger fetch only about 24*s.* per cwt. as a rule. About 1840, ginger fetched as much as 180*s.* per cwt. in London. Jamaica ginger invariably commands the highest price, Calicut or Cochin sorts usually coming second. The plant requires an equable hot and moist climate, a shaded situation, a rich well-tilled, humous or loamy soil, and thrives up to 3,000 feet in Ceylon. It is propagated by division of the tubers or rhizomes, which are planted in rows 2 feet apart, with about 14 inches between the plants in the rows. A harvest is yielded in about ten months from the time of planting, when

the leaves begin to wither. Under very favourable circumstances an acre will yield, it is said, from 2,000 to 2,500 lb. or more cured ginger, but the average return appears to be about 1,200 lb. Ginger has long being highly valued for medicinal purposes, more especially in England; it is also esteemed in preserves and

GINGER. *Zingiber officinale.*

confectionery. *Preserved ginger* is prepared very largely in China, where the plant is extensively cultivated for this purpose.

Grains of Paradise; Guinea Grains, or Melegueta Pepper (*Amomum Melegueta.* Scitamineæ).—A herbaceous bushy perennial 5 to 6 feet high, with arching branches, allied to the Ginger and Cardamom plants, and native of West Tropical Africa. The

flowers and fruit are produced on long trailing cord-like runners, which issue from the base of the plant. The small dark aromatic seeds are imported from the Gold Coast into Europe, where they are used chiefly in cattle medicine, for flavouring cordials, and sometimes for imparting an artificial strength to spirits, wine and beer. At one time they were somewhat largely imported, being used as a substitute for pepper or for adulterating it. In Africa they are largely used by the Natives for seasoning their food, and are considered very wholesome. It is said that about 1,000 cwt. of this spice is imported annually into England, where it fetches at present about 60*s*. to 65*s*. per cwt. In 1912 the export from the Gold Coast alone was over 887 cwt., valued at £2,099.

Mace; "Wasa-vasi" *S*., "Poolie" *T*.—This consists of the net-like wrapper (*aril*) surrounding the nutmeg, inside the husk (see Nutmeg). At first scarlet, it becomes yellowish brown with drying and exposure. Mace is a much-esteemed spice in Europe and America, being used in confectionery and for culinary purposes. In yield, the proportion of mace should be about one-fifth in weight of that of the nutmegs, and one hundred of the latter should produce about 3½ oz. dried mace. *Good pale* to *fine red* mace fetches at present, according to demand, from 2*s*. to 2*s*. 8*d*. per lb. in London.

Massoia, or "Meswi bark," is an aromatic bark obtained from a large tree in New Guinea, closely allied to Cinnamon, and named *Massoia sp.* The tree is not cultivated, and very little is known of it.

Nutmeg; "Sadhika" *S*. (*Myristica fragrans*. Myristicaceæ).—A medium-sized tree, usually 30 to 50 feet high (sometimes 60 to 70 feet), native of the Moluccas, introduced into Ceylon about 1804, and now often met with cultivated in the low-country. The "nutmeg" of shops is the hard brown oval kernel of the fruit. It is enclosed by a thin brittle shell, and immediately surrounding this is the scarlet aril or *mace* in the form of a net, next to which is the thick fleshy juicy husk. The pale-amber fruit resembles a peach or an apricot in form and appearance. When ripe, i.e., about seven months from flowering, the husk splits open and discloses the glossy dark brown nut (seed), covered with the mace, as already stated. They are then picked, or the nuts are allowed to drop to the ground, when they are collected and separated from the mace; both are then dried separately in the sun or in heated

sheds. The nuts, being deprived of the shell, are graded for export; 60 to about 120, according to size, go to a pound, these fetching in London about 8*d*. to 1*s*. 4*d*. for the larger and about 6*d*. per lb. for the smaller sizes. (See also *Mace* above). The tree thrives best in deep loamy and well-drained soil, in a hot and moist climate, up to 1,500 feet elevation. During at least the first five years of its life it is benefited by partial shade from thinly planted shade trees.

CALABASH NUTMEG.—*Monodora Myristica.*

Being usually dioecious—i.e., the male and female flowers are borne on separate trees—it is impossible to tell which sex a tree belongs to until it flowers. The proportion of one male to ten or twelve female trees (or ten males to an acre) should be enough for ensuring fertilisation of the flowers of the latter. The trees become productive at the age of seven or eight years, and increase in yield till they reach about thirty years, when the crop may be 3,000 to 5,000 or more nuts per tree. They produce two crops a year, and

continue productive for very many years. Trees over seventy years old in Peradeniya Gardens bear heavy crops annually, and appear to be still in their prime. Propagation is usually from seed, which take about three months to germinate. Sow in pots or boxes under cover, or in a well-prepared bed in a shady corner; cover with an inch of fine soil, and water daily in dry weather. When the seedlings are old enough to handle, transfer them to baskets or bamboo-pots, and plant out in permanent places when 8 or 10 inches high, at distances of about 26 feet apart. Owing to the uncertainty of the proportion of male to female plants when raised from seed, propagation by budding or inarching has been advocated, but its success on commercial lines seems as yet doubtful. The export of nutmegs from Ceylon during 1912 was 131 cwt. valued at Rs. 3,697, say £300.

Calabash Nutmeg, also called "Jamaica Nutmeg." (*Monodora Myristica.* Anonaceæ).—A small tree of Western tropical Africa, with large oval leaves and sweet-scented flowers, introduced to Peradeniya, Ceylon, in 1897. The large globular fruits contain a number of aromatic seeds, whose odour and flavour are considered to resemble those of the nutmeg proper. The tree is suited to the moist low-country, and thrives in moderately good soil. It has not as yet fruited at Peradeniya.

There are other so called nutmegs, which are of little or no importance as spices, such as the "Brazil Nutmeg" (*Cryptocarya moschata*, Lauraceæ); "Clove Nutmeg" (See "Madagascar Clove,") the Papua Nutmeg (*Myristica argentea*), and the "Wild Nutmeg" of India and Ceylon (*Myristica laurifolia*).

Pepper; "Gammiris" *S;* "Molavu" *T.* (*Piper nigrum.* Piperaceæ).—A creeping perennial vine, indigenous to the moist low-country forests of Ceylon and South India. Both "black" and "white" peppers are obtained from the same plant. The berries (pepper-corns) when of a reddish colour are picked and spread in the sun, when they become black and shrivelled. These, when ground with the outer covering left on, form "black pepper;" deprived of the black covering (first by soaking in water for 7 or 8 days, then rubbed or macerated with the feet or otherwise), "white pepper" is obtained. A decorticating machine has been invented by which the dried black corns can be converted into white pepper. The pepper vine requires a moist heat with shade, and thrives up to 1,500 feet above sea level. Artificial or natural supports, in the form of posts or trees, are necessary, the latter

being preferable and more durable. Erythrina, Mango, Jak and other quick-growing trees answer well for the purpose of supports, while they also provide a beneficial light shade. In Sumatra and Malaya, posts of some hard and durable wood are generally used for supports. Propagation is best by cuttings, which should be selected from the ends of the best bearing vines, and may

PEPPER.—*Piper nigrum.*

either be started in a nursery bed, or planted out *in situ* where they are to remain. A small crop may be expected in the third year from planting, but the vines will not be in full bearing till the sixth or seventh year. In India, Malaya, and Ceylon, the main crop is produced usually from March to May, and a smaller crop may sometimes be obtained in August or September.

It is considered that, with good cultivation, an annual yield of about 2,000 lb. or more per acre should be obtained, allowing for the plants (stools) to be planted 7 ft. by 7 ft., say 880 to the acre. The most economical method of Pepper cultivation is to grow the vines on trees which are used as shade along roadsides or for other crops, as "Dadaps" in Tea or Cocoa, the cultivation in this case costing but little. Pepper plants will continue to yield good crops for twenty-five to thirty years. The present market price of "black pepper" in London ranges from 4*d.* to 5½*d.* per lb., "white pepper" usually fetching 2*d.* to 3*d.* per lb. more. The chief

PEPPER VINES ON KAPOK TREES *(Eriodendron)*, CEYLON.

sources of supply are Penang, Sumatra, and Malabar. Ceylon exported over 350 tons of pepper in 1912, valued at £15,750.

Pepper, Cayenne.—This is made by drying and grinding the smaller and most pungent kinds of chillies, the fruits of species of Capsicum, especially *C. annuum* and *C. minimum*. The Cayenne-pepper of shops is said to be usually adulterated with flour or other powders.

Pepper, Long.—This consists of the unripe fruiting spike of *Piper Longum*, dried in the sun. The plant is a native of India and Ceylon, and is cultivated in parts of India. "Long pepper" is

used chiefly in medicine, being less pungent than "black" or "white" pepper.

Pepper, Japan. (*Xanthoxylon piperitum.* Xanthoxylaceæ).—A deciduous tree of Japan, the black aromatic pungent fruits of which resemble pepper-corns, and are used as a spice in Japan.

Pepper, Ashantee. (*Piper Clusii.* Piperaceæ).—A handsome wild pepper vine of Western tropical Africa, the corns of which are used in its native country as a spice, and were at one time exported to Europe. It is not cultivated.

Pepper, Negro. Ethiopian, or West African pepper. (*Xylopia aromatica.* Anonaceæ).—A tall shrub, native of Western Africa, producing clusters of pod-like fruits which are about 2 inches long. These have aromatic and pungent properties, and when dried are used in Western tropical Africa instead of pepper.

Star Anise. (*Illicium verum.* Magnoliaceæ).—A shrub or small tree, native of Southern China, where it is cultivated for the sake of the fruits which when ripe burst open and spread out in the form of a star. The whole fruit is agreeably fragrant and aromatic and, in China and Japan, is much used as a condiment in cookery, also for chewing after meals to sweeten the breath, and as a digestive. It forms an important article of commerce in the Far East, and is imported into Europe and America to some extent for flavouring liqueurs and spirits, being the chief flavouring ingredient in the French "Anissette de Bordeaux." An aromatic oil ("anise oil") is obtained from the fruit by distillation, which is usually quoted at from 6*s* to 7*s* per lb. in London. Seeds have been imported on different occasions at Peradeniya and sown, but these have never germinated. It is said that the Chinese always boil the seed before it leaves the country, so as to maintain the monopoly of the spice. The "Japanese Star Anise" is the fruit of *Illicium anisatum*, which has somewhat the odour of Bay-leaves.

Turmeric; "Kaha" S. (*Curcuma longa.* Scitamineæ).—A perennial herb, about 2 feet high, cultivated throughout tropical Asia. The rhizome or tuberous roots are of a yellow or orange-yellow colour and waxy resinous consistency; they are ground into a fine orange-yellow powder, which has an aromatic taste, somewhat resembling ginger. This is commonly used as a condiment in native cookery, and is a prominent constituent of curry powders, being also employed in India for dyeing wool and silk. Turmeric

is cultivated in India, whence it is chiefly exported to Europe, etc. Its price in London ranges from about 3*d.* to 6*d.* per lb. or 18*s.* to 24*s.* per cwt. The plant is propagated by the rhizomes or by division of the crown, and is suited to loose rich soil, under partial shade; it thrives in a hot and moist climate up to 2,000 feet. Under average circumstances an annual yield of about 2,000 lb. per acre may be obtained. Cultivation is much the same as for Ginger. The tubers should be dug up as soon as the stems fade. They are prepared for market by drying in the sun, being, as a rule, previously scalded in hot water to check or destroy their vitality.

Vanilla. (*Vanilla planifolia.* Orchideæ). A large creeping orchid with long fleshy leaves, native of Mexico, introduced into Ceylon in 1847. "Vanilla Beans" are the dried and cured pod-like fruits, so much esteemed from early times for flavouring and perfumery. *Vanillin*, the active principle of vanilla, has of late been produced artificially, and this together with over-production of the natural article has resulted in making the latter a less profitable cultivation. The vine thrives best in a hot and fairly humid climate, from sea-level to about 1,500 feet. It requires support in the form of light-foliaged trees, trellises of bamboo or other material, or hedges, etc., and a mound of humous, porous soil or leaf-mould should be placed around its roots at the base. Among the best live supports for Vanilla are Physic-nut (*Jatropha Curcas*), Calabash (*Crescentia Cujete*), Dadap (*Erythrina*), and the Temple Tree (*Plumeria*). Cuttings of the vine about 3 feet long should be planted against the trees or other supports, and tied up to these until established. At the end of eighteen months the plants should be pruned back to induce accessible branches. Frequently, however, they are allowed to run up the trees to a height of about 10 or 12 feet, after which the ends of the vines droop over.

A crop may be expected in three years from the time of planting. The principal flowering season of the vine in Ceylon is April to May, and the crop is gathered 8 to 9 months later. In heavily shaded situations the fruits take longest to ripen. In the plant's native home, the flowers are fertilised by bees and humming birds; but in cultivation this seldom occurs, and it is necessary to pollinate or "marry" the flowers by hand, as otherwise few if any fruits will set.

The marrying process must be done in the morning or forenoon, while the pollen masses and the receptive stigma are fresh. The operation consists in lifting the adhesive pollen masses

on a pencil, and bringing these in contact with the viscid stigmatic surface. An expert can pollinate from 600 to 700 flowers in half a day. Not more than six flowers in a cluster should be fertilised, and a vine should not be made to bear more than twenty-five to thirty pods, half that number being sufficient for a weak plant. The fruits should be ready for gathering in 8 to 9 months after fertilisation of the flowers, the proper state for harvesting being indicated by a slight yellowing at the end of the pods. The latter when collected are dipped into almost boiling water for about 20 to 30 seconds, then placed in the sun to dry, after which they

VANILLA, SHOWING LEAVES AND (A) PODS.

are "sweated,"—i.e., rolled up in blankets every morning and placed in a closed box to ferment, being taken out and spread in the sun during the day. Excepting the dipping in hot water, this process may be continued for about ten days or more, when the pods will have become brown. In Seychelles, instead of placing the pods in the sun each day, they are spread on trays in a heated room (in a temperature of say 90° to 100° Fah.), between double blankets. After this they are treated in a cooler temperature in the shade, the beans being occasionally squeezed between the fingers and drawn through, so as to render them pliable and

distribute the minute seed in the interior. This process takes a few weeks longer. It is considered that the more slowly vanilla is dried the better. When the curing is complete, vanillin accumulates as crystals on the pods, giving these the appearance of being covered with a fine bloom. Pods which are inclined to split should be tied up at the end with a piece of thread. If for

VANILLA VINES ON GLIRICIDIA TREES.

export, it is necessary to further dry and occasionally turn the pods, under cover, for five or six weeks, when they may be graded according to lengths, made up in pound-packets and packed in soldered tins for export. On an average, 125 cured pods will weigh a pound. The standard size of tin boxes used in Seychelles for exporting vanilla is 13 inches long, 9 in. broad, and 6 in. deep. A lining of parchment paper is placed in each, the pods are packed fairly loosely, and the lid secured by solder. It is more particularly as a secondary crop that vanilla is to be recommended for cultivation.

An acre of good healthy vines (say about 680 plants) is considered to give a return of about 200 lb. of cured pods. The yield per acre in Hawaii has been estimated to approximate 13,000 pods, amounting to about 120 lb. of cured beans. The price of vanilla fluctuates considerably. At present, London prices are approximately:—*Fair* to *good* (7½ to 8½ inch) 16*s*. to 18*s*. per lb.; 3 to 6½ inch, 13*s*. to 15*s*. 6*d*.; *Mouldy*, 6*s*. 6*d*. to 13*s*., and inferior qualities from 4*s*. per lb. upwards. The export of vanilla from Ceylon in 1912 is given as 23 cwt. valued at nearly Rs. 20,000, and that from Reunion as 51 tons, against 70 tons in 1908.

Vanillon, or Vanilloes.—(*Vanilla pompona*).—A native also of Mexico, yielding an inferior quality of vanilla known by the names of "Vanillon" and "Vanilloes." This is claimed, however, to have advantages over proper vanilla, its pods not having a tendency to split as well as being easily cured, whilst the vines are said to flower and fruit three or four times during the year. Vanilloes fetch from 1*s*. 6*d*. to 3*s*. per lb. in London.

Vanilla Essence.—According to the *Journal of the Jamaica Agricultural Society*, this product is prepared in Jamaica from vanilla beans, and is sold at 20*s*. per gallon, which is said to be equivalent to 10*s*. 6*d*. per lb. of cured beans.

Synthetic Vanillin. Notwithstanding the introduction of this article, there appears to be at present a fairly remunerative demand for vanilla, the uses of which are numerous and increasing. The vanilla crops of Reunion and Seychelles have been in a flourishing condition during the last few years, in some seasons realising an average price of 16*s*. per lb. With the legislation in France and the United States restricting artificial food substitutes, there has been a continuance of remunerative prices for the past two or three years for vanilla, and there is said to be now a reluctance on the part of manufacturers to use the artificial vanillin.

Winter's Bark. (*Drimys Winteri*. Magnoliaceæ).—A small tree of temperate South America, the bark of which is aromatic, and sometimes used as a spice in medicine. The tree is well established at Hakgala Gardens, Ceylon, being suited only for up-country.

CONDIMENTS AND SEASONING HERBS

Aniseed. (*Pimpinella anisum*. Umbelliferae).—An annual, cultivated in the South of Europe for its small seed-like fruits, which are much used in confectionery and in the manufacture of a

well-known cordial. The leaves are also used for flavouring purposes and garnishing. The plant requires a light rich soil, and may be grown from seed sown in drills 8 inches apart. Suited to a rather dry climate. It is said to be commonly grown on the plains in India, but is not cultivated in Ceylon. Aniseed usually fetches from 24*s*. 6*d*. to 26*s*. per cwt. in London.

Basil, Sweet; "Suwanda-Tala" *S.* (*Ocimum basilicum.* Labiatæ).—An annual about a foot high, native of India and naturalised or commonly grown in the low-country of Ceylon. It is cultivated in Europe and elsewhere for its highly fragrant and aromatic leaves, which are used for flavouring soups, etc., but their strong odour is disagreeable to many persons. The plant is sacred to the Hindus, and is commonly cultivated near their temples. Thrives best at low and medium elevations.

Borage. (*Borago officinalis.* Labiatæ).—A small annual with coarse hairy leaves and pretty, blue flowers, both of which are sometimes used in Europe for garnishing, but more frequently as an ingredient in claret-cup. It is not often grown in Ceylon, nor in India, though it thrives at the higher elevations, especially in the dry seasons.

Caraway. (*Carum Carui.* Umbelliferæ).—A biennial, native of Eastern Europe, 1½ to 2 feet high, cultivated for its well-known aromatic seeds which are much used in confectionery, also for flavouring spirits and perfuming soap. It does not seem to be anywhere grown in Ceylon, although it would probably succeed in dry districts at moderate elevations, as in Uva. The seed should be sown in drills one inch deep, with 12 inches between the drills, the plants being afterwards thinned out as may be necessary.

Chervil. (*Anthriscus cerefolium.* Umbelliferæ).—An annual, native of Europe, the young leaves of which are sometimes used as an ingredient in salads and for flavouring purposes. Suited to the higher elevations. Sow seed broadcast on a bed of smooth surface.

Chives. (*Allium schœnoprasum.* Liliaceæ).—A small perennial, cultivated for its leaves, which are used in salads and soups instead of young onions. It is propagated by seed or division of the roots, and will grow in ordinarily good soil. The plant is little known in India or Ceylon, and the same is probably true of the rest of the tropics.

Clary. (*Salvia Sclarea.* Labiatæ).—A small biennial, the leaves of which are sometimes used for flavouring soups, etc. Seed

may be sown in drills about 16 inches apart, or in boxes, the seedlings being afterwards transplanted at a distance 9 or 10 inches apart. Sometimes grown in Hill gardens.

Coriander. "Kothamallie" *S.* (*Coriandrum sativum.* Umbelliferæ).—An annual, cultivated in Europe as a seasoning herb; also commonly grown in India, from which large quantities are exported. The young leaves are used for flavouring soups and salads, and the seed in confectionery, medicine, etc. Succeeds in ordinary soils. Propagated from seed, which may be sown in drills, the plants being afterwards thinned out to 1 foot apart. In India the seed is usually sown broadcast.

Curry-Leaf.—See "Karapincha."

Cummin; "Sudu-duru" *S.*; "Shiragam" *T.* (*Cuminum Cyminum.* Umbelliferæ).—An annual, 1-2 ft. high, with Fennel-like feathery leaves, and seeds (fruits) like Caraway, but slightly larger and lighter in colour than the latter. This appears to have been cultivated in Palestine from very early times, as it is mentioned in the Old and New Testaments. Cummin has similar properties to Caraway and Dill, and at one time largely took the place of these in confectionery and medicine. It is still employed in Germany, Holland, etc., and very largely imported into tropical South America generally, where, I am informed, it takes precedence of all other condiments for seasoning purposes. It is also imported into India, Ceylon, Straits, etc., and sold everywhere in the bazaars or boutiques as a condiment for meat-curries and such like. Apparently it is nowhere cultivated within the Torrid Zone. The chief sources of production are Malta, Persia, Turkey and Morocco, though it is said to be also somewhat extensively grown in the Punjab and N. W. Provinces of India. "Ordinary" to "good" Morocco cummin seed fetches in London from 20*s.* to 22*s.* per cwt., and "common" to "fair" Malta 27*s.* to 29*s.*

"Black Cumin," which is extensively cultivated in India, is the seed of *Nigella sativa*, a Ranunculaceous plant, native of Southern Europe.

Dill. (*Peucedanum graveolens.* Umbelliferæ).—A biennial of Southern Europe, the aromatic leaves of which are used in soups, sauces, etc.; the seeds yield an oil of medicinal value and from which the well-known "Dill-water" for infants is made. The plant is of easy culture, and thrives in various parts of India. Seed may be sown in drills, and the plants afterwards thinned out.

Fennel; "Maha-duru" or "Bata-anduru" *S.* (*Fœniculum vulgare.* Umbelliferæ).—A herbaceous perennial, native of South Europe, commonly grown in Ceylon as well as in India. In North-Western India it is sometimes grown as a field crop for its fruit. The tall, finely-divided aromatic leaves are used in fish-sauces and for garnishing, the leaf-stalks are employed in salads, and the seeds in confectionery and for flavouring liqueurs. Propagated from seed, which may be sown in boxes, the plants being afterwards put out 12 inches apart in rows. The plant thrives best in moist situations, being suited to elevations of 2,000 feet upwards.

Garlic; "Sudu-lunu" *S.* (*Allium sativum.* Liliaceæ).—A bulbous-rooted perennial, native of Central Asia and naturalised in Southern Europe. It is much cultivated in India and the East generally for its small white, onion-like bulbs. These are sometimes used in Europe for flavouring soups, stews, etc. In India, Ceylon and many other tropical countries, they are universally sold in the bazaars or boutiques, being largely used in native cookery and medicine. The plant will thrive almost anywhere on the plains or hills, but succeeds best in light, rich and rather dry soil. It is commonly cultivated by the Natives of Ceylon, but the market supplies are imported principally from India. Propagated by the bulbs.

Horehound. (*Marubium vulgare.* Labiatæ).—A small perennial, sometimes cultivated in England as a pot-herb. A decoction of the leaves is a popular remedy for coughs, etc. Not commonly grown in Ceylon or India. Propagated by seed.

Horse-radish. (*Cochlearia Armoracia.* Cruciferæ).—This well-known plant is commonly grown in Hill gardens throughout India, Ceylon, etc., but is quite unsuited to the plains or low elevations. The bitter tuberous roots, which are scraped or grated, are used in soups, sauces, etc. The plant is propagated by division of the roots, with a portion of the crown attached, and thrives best in a deep, rich and rather moist soil. Deep holes may be made about 15 inches apart, in rows, and filled in with well-manured soil. Four or five months are required to mature a crop. By clearing away the soil from the upper portion of the root, and removing the fibrous side-roots, the main root becomes thicker and longer.

Horse-radish Tree; "Murunga" *S.* (*Moringa pterygosperma.* Moringeæ).—A small tree, the main thick root of which is commonly used throughout India as a substitute for horse-radish, to which, however, it is much inferior in flavour. The long

pods, produced chiefly in March and April, are very generally consumed by the Natives, in an unripe state, as a curry vegetable.

Hyssop. (*Hyssopus officinalis.* Labiatæ).—An aromatic dwarf shrub, cultivated in European gardens. The leaves are sometimes used for flavouring, as well as in medicine. Propagated by seed. Succeeds in light rich soil; not suited for low elevations, but may be grown in the Hills.

"Karapincha" *S.*; "Karivempu" *T.*; Curry-leaf. (*Murraya Koenigii.* Rutaceæ).—A small tree of the Orange family, native of Ceylon, and found chiefly in the dry region. It is familiar as the Curry-leaf plant, the pungent aromatic leaves being a constant ingredient in curries, mulligatawny, etc. It prefers light rich soil, and with cultivation will thrive up to at least 2,000 feet in Ceylon. Propagated from seed, which are in season in April.

Lavender. (*Lavendula vera.* Labiatæ).—A dwarf shrub, native of South Europe, commonly grown for its pleasantly scented flowers, which are dried and put into wardrobes, etc. The aromatic leaves are sometimes used as an ingredient in seasonings. The plant is cultivated commercially for the highly-esteemed perfume, Lavender-water, obtained by distillation of the flowers. Lavender succeeds in the Hill gardens in India and Ceylon; at Nuwara-Eliya it flowers and seeds freely. Propagated from seeds or cuttings

Lemon-grass; "Sayra" *S.* (*Andropogon citratus.* Gramineæ).—The white fleshy heart of the leafy stalks of this well-known fragrant grass (cultivated for the Lemon-grass oil, obtained from the leaves) are very generally used by the Natives of Ceylon for flavouring curries, being also sometimes used in pickles. The stalks are commonly sold in the markets and bazaars at ½ cent each.

Marigold, Pot. (*Calendula officinalis.* Compositæ).—An annual of Southern Europe, commonly grown as an ornamental flowering plant. Its flowers are edible, and on the Continent of Europe are generally used for flavouring soups, etc. The plant is commonly grown for its showy flowers, at medium and high elevations.

Marjorum, Sweet. (*Origanum Marjorana.* Labiatæ).—A biennial, native of Northern Africa, etc., cultivated in European gardens for its aromatic leaves, which are used both green and dried for seasoning soups, etc. It is propagated by seed, and is adapted to cultivation in Hill gardens in the tropics.

Marjorum, Pot. (*Origanum Onites*).—A perennial, native of Sicily. Propagated by division of the roots.

Mint; "Meenchi" *S.* (*Mentha viridis.* Labiatæ).—A small herbaceous perennial with creeping rhizomes. It is one of the most valuable of all seasoning herbs, and is universally cultivated in temperate climates. The tops and young leaves are used for flavouring in numerous ways, as in soups, salads, and sauces, or boiled with peas, potatoes, etc. The plant grows freely in Ceylon hill gardens, becoming acclimatised in places; it also thrives moderately well in damp and shady places in the low-country. It is easily propagated by division of the roots and underground stems, and is especially suited to a moist rich soil.

Mustard; "Aba" *S.*; "Kadugu" *T.* (*Sinapis nigra*; *Brassica juncea.* Cruciferæ).—A small annual, introduced into Ceylon and now naturalised in waste places in the low-country. The small seeds, when powdered, form the well-known condiment mustard; they are also used whole for flavouring pickles and numerous preparations. In Europe the plants, when very young, are used as salad, usually with cress. Propagation by seed; sow broadcast on a smooth surface of loose, friable soil.

Parsley. (*Petroselinum sativum.* Umbelliferæ).—From early times this has been cultivated as a medicinal plant. It is now universally grown for seasoning and garnishing purposes, and no garden is complete without it. It grows luxuriantly in up-country gardens and, with some shelter from the sun and heavy rains, will also thrive tolerably well at medium and even low elevations. Seed is best sown at the end of the heavy rains, or, on the plains, before the cold weather sets in, either in drills in the open, or in boxes under cover, afterwards transplanting the seedlings out with a good ball of the earth in which they germinated. Parsley thrives best in a rich soil; in the low-country, a damp shady situation suits it best. There are many varieties, among those well-known being "Myatt's Garnishing," "Sutton's Imperial Curled," "Fine Doubled Curled," etc.

Rosemary. (*Rosmarinus officinalis.* Labiatæ).—A dwarf shrub, native of South Europe, and commonly grown in European gardens for its pleasantly fragrant leaves. These are occasionally used for seasoning, and a decoction is made from them for relieving headaches and for hair-wash; they are also used in the manufacture of Eau-de-Cologne and other scents. Propagated from seed. Suited for Hill gardens.

Rue; "Herb of Grace." (*Ruta graveolens.* Rutaceæ).—A small under-shrub with glaucous greyish leaves, commonly grown in gardens in Europe. The leaves have an unpleasant smell and a hot bitter taste; they are sometimes used for garnishing, but more frequently in medicine on account of their carminative properties. The plant grows well in shaded spots at medium elevations, but does best in the Hills. Propagated from seed or cuttings.

Sage. (*Salvia officinalis.* Labiatæ).—This well-known seasoning plant is successfully cultivated in Hill gardens in the Tropics. It will also succeed fairly well at intermediate elevations by sowing seed at the end of October or early in November. Though usually propagated by seed, it may also be raised by cuttings. The plant is a small evergreen shrub, native of South Europe, and thrives best in light rich soil.

Samphire. (*Crittinu n maritimum.* Umbellifereæ).—A small, sea-coast perennial, native of Europe, sometimes cultivated for its leaves, which are used in salads, also as a seasoning and for pickling vinegar. The plant requires a light sandy soil and a moist situation. Sprinkling it occasionally with salt water is said to encourage its growth.

Savory, Summer. (*Satureia hortensis.* Labiatæ).—An annual, native of Italy, frequently cultivated in gardens in Europe as a seasoning herb. The whole plant is aromatic, and the tops are used for flavouring salads and soups; they are also boiled along with peas, beans, etc. Though well suited to Hill gardens in the tropics, the plant is seldom grown in Ceylon. Propagated from seed or by crown division.

Savory, Winter. (*Satureia montana*).—A small, evergreen shrub, native of South Europe, often grown for seasoning purposes. Cultivation the same as for Summer-savory. Propagated from seed or by division of the crowns.

Shallots.—See under *Temperate or Sub-tropical Vegetables.*

Sweet Basil.—See *Basil.*

Tarragon. (*Artemisia Dracunculcus.* Compositæ).—A small perennial, native of Siberia, cultivated for its aromatic leaves; these and the young tops are used in salads and soups, being also pickled with cucumbers; an infusion of them forms the much-esteemed Tarragon-wine, also Tarragon vinegar. The plant requires a light free soil, and is generally propagated by division of the roots. It does not seem to be well-known in the Hill gardens

of Ceylon or India, though there seems no reason why it should not thrive there.

Thyme. (*Thymus vulgaris.* Labiatæ).—This small undershrub is a favourite amongst seasoning herbs. The aromatic leaves are generally relished as a seasoning in soups, stuffings, etc. The plant thrives in Up-country gardens, prefers a light rich and rather dry soil and a sheltered situation. It is propagated by seed, which may be sown broadcast on a bed with smooth surface, or in shallow drills 8 inches apart. The seedlings should afterwards be thinned out to distances of about 3 inches each way; or seed may be sown in pots under cover, the seedlings being pricked out and transplanted when strong enough.

SECTION 3

CHAPTER XV.

BEAUTIFUL FLOWERING AND FOLIAGE TREES OF THE TROPICS

Suitable for Low or Medium Elevations

FLOWERING TREES:—

[*S*=Sinhalese; *T*=Tamil.]

Properly speaking, all trees are *flowering trees*, that is, they normally produce flowers, whether these be showy or inconspicuous; but, for practical purposes, only such as may come under the term commonly understood as "flowering trees" are here included. For trees whose beauty consists chiefly in their form of foliage, see *Ornamental Foliage Trees.* Many of the following species, however, combine to a large extent both beauty of foliage and flowers. Some flowering trees are deciduous and develop their floral display when devoid of leaves (e.g., Red Cotton Tree, or Bombax), while others are in their full glory of foliage and blossom simultaneously, as the Amherstia, Spathodea, etc. Flowering trees in the tropics may be employed for useful as well as for ornamental purposes, as (when suitable kinds are available) for planting for shade in thoroughfares, parks, or pleasure grounds. It is asserted, with sound reason, that the planting of bright flowering trees around bungalows situated in lonely districts and surrounded by monotonous plantations, would go far to relieve the depressing effect often inseparable from such situations.

Flowering trees for street-planting, etc.—An important quality of a flowering tree is its suitableness for planting in public thoroughfares. For this purpose it should obviously be an ever-green, or at least have the habit of developing young foliage soon after the shedding of the old leaves. *Peltophorum ferrugineum* and *Inga Saman* ("Rain Tree") for example, answer this purpose admirably. If the name of the tree employed is such as to lend itself to use as

a street name, it might with advantage be so adopted; for while thus tending to impress the charm of the tree, the name would obviously be an improvement on some of the street names now in use. For example, "Amherstia-avenue" would be preferable to "Slave-Island Road," "Cassia-terrace" to "Jail road," "Spathodea-grove" to "Paranawadiya-lane," and so on. The following are

VIEW IN MAIN CENTRAL DRIVE, PERADENIYA GARDENS.

some of the most beautiful flowering trees of the tropics, given in alphabetical order. By coincidence, the first on the list is perhaps the finest flowering tree in the world.

Amherstia nobilis. *Leguminosae.* Named in honour of LADY AMHERST.—A medium-sized tree, native of Burma, and considered the most beautiful of all flowering trees. Its immense candelabrum-like sprays of red and yellow flowers, drooping from every branch among the handsome foliage, present an appearance of astonishing

elegance and loveliness. It is in flower during the greater part of the year, but its chief flowering season in Ceylon is from January to April, i.e., the dry season. The tree thrives in the moist low-country up to 1,600 feet, and requires rich and well-drained soil. It does not seem to flourish near the sea, and is rarely met with about Colombo. It produces seed very scantily anywhere, a pod or two occasionally being all that can be obtained, and even these are often infertile. Propagation by layering has, therefore, to be adopted. Introduced into Ceylon in 1860.

Bauhinia. *Leguminosae.*—Several species and varieties of this genus afford us small but beautiful flowering trees, such as *B. purpurea* with very showy large flowers of a pink shade merging into purple, *B. triandra* or "Mountain Ebony" (somewhat similar to the latter), and *B. tomentosa* or "Kahapetan" with yellow flowers. The genus takes its name from Bauhin, the twin brother botanists, from the fact that the leaves are joined in twos at the base.

Brownea ariza. *Leguminosae.*—A small spreading tree with pinnate, drooping foliage, native of Tropical America, introduced into Ceylon in 1884. It bears from the ends of the branches very large dense round clusters of blossom which practically weigh down the branches. The flowers are of a deep rose-colour, of great beauty, and resemble in form large Rhododendron flowers.

B.—coccinea (Scarlet).—A short spreading tree, native of South America and introduced into Ceylon in 1849. It is distinguished from the other Browneas by the small but numerous clusters of scarlet flowers, produced on the stem and older branches.

B.—grandiceps (Large-headed).—A larger and handsomer tree than either of the former two species, native of Venezuela, introduced into Ceylon in 1870. A very beautiful tree when in blossom, the bright-red flowers being borne in very large dense heads at the ends of the branches. The foliage, too, is very handsome, the young leaves being produced in long, drooping flaccid bunches, similar to those of Amherstia.

B.—macrophylla (Large-leaved).—A strong-growing species, introduced at Peradeniya in 1894. It is of a less free-flowering habit than the three species above named, but the flower heads are larger, and of a pleasing shade of rose-colour; the very large and bright-coloured stamens also distinguish the flowers from those of the other species of Brownea.

Butea frondosa. *Leguminosae.* Bengal "Kino Tree." "Gaskela," *S.*; "Parasu," *T.*—An erect tree with trifoliate leaves, indigenous to the forests of the dry region of India, Ceylon, and Burma; reaches a height of about 40 feet, and bears in the dry months a profusion of orange-scarlet flowers. The tree furnishes a resin ("kino") and a useful fibre; a lac is produced on the young twigs, and the flowers are used in India for producing a yellow and orange-red dye.

THE RIVER DRIVE PERADENIYA GARDENS.

Cassia Fistula. *Leguminosae.* Indian Laburnum; "Pudding-pipe"; "Ehela" *S.* "Tirukkontotai" *T.*—A small upright tree, common in the forests of the dry region of Ceylon and India. It forms a beautiful object when in blossom, the flowers being bright-yellow, borne in numerous large pendulous racemes. The flowers are used as temple offerings, and the astringent bark for tanning and in native medicine. The black, cylindrical pods grow to a length of from 20 to 30 inches; the pulp of these is a well-known purgative. Suited chiefly to the rather dry region, but with good drainage will thrive in moist districts up to 2,000 feet elevation.

Cassia grandis (Great). "Horse Cassia." A native of South America, growing to a height of about 40 to 50 feet; bears a profusion of pale pink inflorescence during the dry months of February and March, when the tree is completely deciduous. It produces in June an abundance of thick, coarse and slightly curved pods, the pulp of which has an offensive odour.

C.—marginata=C.—Javanica. (Marginated leaf). "Ratu-wa" *S*; "Vakai" *T*.—A small, graceful tree with spreading, drooping branches, common in the dry region of Ceylon and also in South India; very ornamental when bearing its racemes of rose-coloured flowers, usually in July and August.

C.—multijuga (Many-pinnæ).—A slender quick-growing tree of Tropical America, introduced to Peradeniya, Ceylon, in 1851. Remarkably beautiful when in full blossom, during August and September, being practically smothered with very large racemes of bright yellow flowers, suggesting a glorified Calceolaria. The tree luxuriates in the moist climate of Peradeniya, but rarely produces seed here. At Anuradhapura, however, in the drier region, it bears fruit abundantly. It may be propagated by cuttings when seeds are not procurable.

C.—nodosa (Knotted, referring to the knotted stems).—A moderate-sized tree, native of Eastern Bengal and Malaya, very beautiful when bearing its profusion of bright pink and rose-scented flowers, during May and June. The flowers are followed by cylindrical pods, 12 to 15 inches long. The tree is deciduous in the dry weather.

Cochlospermum gossypium. *Bixaceae.* "Kinihiriya" or "Ela-imbul" *S*, "Kongu" *T*.—A rather small tree, native of Central India. It has become semi-naturalised in some dry parts of Ceylon, and is often found planted near Buddhist temples. A beautiful tree when in blossom (during February and March), with its large bright yellow flowers, which are esteemed as temple offerings. The tree is deciduous in the dry weather; thrives in either dry or moderately wet districts below 2,000 feet.

Colvillea racemosa. *Leguminosae.* Named in honour of Sir Charles Colville, when Governor of Mauritius.—A medium-sized tree, 30 to 40 feet high, with handsome pinnate leaves, native of Mauritius and Madagascar. It bears in September large, erect, close racemes of bright scarlet flowers, presenting a very showy appearance. Suited to the moist or moderately-dry low-country.

Couroupita guianensis. *Myrtaceae.* Cannon-ball tree.—Though not ordinarily a beautiful tree, it is very striking when bearing its huge woody racemes (4 to 6 feet long) of very curious pink and white fleshy flowers. These are followed by large brown globular fruits, which attain the size of the human head and contain a mass of very sour-smelling pulp. The tree is a native of tropical South America; introduced at Peradeniya in 1881, and has flowered and fruited regularly since 1898, when it flowered here for the first

"MADRE." *Gliricidia maculata.*

time. Suited to the moist low-country. Propagated by seed. *(See illustration).*

Gliricidia maculata. *Leguminosae.* "Madre" of South America.—A small, quick-growing, elegant tree, introduced from the West Indies about 1889. It bears long, arching, feathery and leafy branches, which in the dry weather drop nearly all their leaves and produce along the greater part of their length masses of pinkish-purple flowers, making the tree a striking object for a

time. It thrives up to 2,500 feet, and may be seen flourishing in the Victoria Park and elsewhere about Colombo. Its quick growth and light feathery habit commend it as a shade tree for

JACARANDA MIMOSÆFOLIA. SHOWING LEAVES AND FLOWERS.

crops and green-manuring. For the latter purpose it has also the merit of belonging to the nitrogen-collecting tribe of Leguminosæ. The tree forms a good support for Vanilla vines. It is considered

to have been first introduced into Ceylon by MR. C. DRIEBERG, when Superintendent of the former Agricultural School at Colombo.

Jacaranda mimosæfolia. *Bignoniaceae.*—A very elegant tree, both on account of its leaves and flowers. It reaches a height of 40 to 50 feet, and bears at different seasons, but chiefly in the drier months, a profusion of blue bell-shaped flowers on the young shoots as well as on the older branches. The elegant bi-pinnate Mimosa-like leaves make the seedlings well worth growing as small ornamental foliage plants in pots.

Kleinhovia hospita. *Sterculiaceae.*—A large handsome Malayan tree, introduced into Ceylon about 1820. It bears large terminal panicles of pink or rose-coloured flowers, which appear during July or August. Thrives in the moist low country.

Lagerstroemia flos-reginæ. *Lythraceae.* "Pride of India," "Murutu" *S.*—A tree of about 50 to 60 feet in height, native of Ceylon, India, and Malaya. It is undoubtedly one of the most strikingly showy of flowering trees, and from April to July or later bears from the ends of the branches huge panicles of large beautiful mauve or pink flowers. The older trees are deciduous for a short period during the dry weather. There are two or more varieties; a variety which is common in Ceylon has lovely bright-pink flowers, and is exceedingly attractive.

L.—tomentosa. A moderate-sized handsome tree, native of hot and moist parts of Burma, introduced at Peradeniya in 1891. It blossoms twice a year, in April and October, bearing large erect panicles of lovely bright flowers, produced from the end of every branch. A very ornamental tree when in blossom.

Ligustrum Walkeri. *Oleaceae.* Ceylon Privet.—A small shrubby tree, with fine foliage, producing after the rains large clusters of creamy-white scented flowers. It is indigenous to the lower montane zone of Ceylon (3,000 to 5,000 feet), and is propagated from seed.

Lysidice rhodostegia. *Leguminosae.*—A large handsome tree, native of Southern China, introduced at Peradeniya in 1882. It thrives here and bears from December to February masses of pink or rose-coloured erect inflorescence, produced from the extremities of the branches. The persistent coloured calyces render the tree very showy for several weeks.

Mesua ferrea. *Gulliferae.* "Iron-wood;" "Na-gaha" *S*, "Naka" *T.*—A moderate-sized, broad, conical, slow-growing tree, native of the hot and moist regions of Ceylon, India and Malaya.

This handsome tree is much in favour for planting near Buddhist temples. It blossoms profusely in the month of April or May, the large white flowers, with their big bunch of yellow stamens, being delicately scented. The young leaves, which appear twice a year, are of an intense blood-red colour, passing through delicate shades of pink into the dark-green of the adult growth.

Millingtonia hortensis. *Bignoniaceae.* Indian Cork-Tree.—An erect tree with dark-green finely divided leaves, reaching a

CEYLON IRON-WOOD. *Mesua ferrea.*

height of 59 feet or more; bears in November and June a profusion of long, pure-white fragrant flowers. The tree is a favourite in Indian gardens; thrives up to 2,000 feet in Ceylon.

Oncoba spinosa. *Bixaceae.* A small bushy tree of Arabia, with light-green, small ovate leaves. It bears during April, from the underside of the young branches, large, single, white flowers with yellow stamens; these are delicately scented and suggest in appearance large dog-roses. Introduced at Peradeniya in 1885, but has not as yet set fruit here.

Peltophorum ferrugineum. *Leguminosae.* "Iyavaki," *T.*—A large, quick-growing, symmetrical tree, with a spreading top and fine graceful feathery foliage, indigenous to Ceylon and Malaya. The young leaves and shoots are covered with a brown velvet tomentum, from which the tree takes its specific name. The tree flowers twice a year at irregular seasons, some specimens being in blossom while others by its side are in ripe fruit. The flowers are rusty-yellow, sweet-scented, and borne in large erect panicles. TRIMEN, in his *Flora of Ceylon*, stated: "It is a magnificent sight when in full blossom." It is specially suited to dry districts, but also thrives to perfection in the moist region up to 1,800 feet.

ONCOBA SPINOSA.

Plumeria acutifolia. *Apocynaceae.*—Temple Tree; Pagoda Tree; sometimes called "Frangi-pani;" "Awariya," *S.*—A low spreading succulent tree or large shrub, originally introduced from Tropical America and now naturalised in Ceylon, India, etc. It is a familiar tree in the Eastern tropics, especially throughout the low-country of Ceylon, being often planted near Buddhist temples. The tree is almost or quite bare of leaves throughout the dry weather, when it bears large corymbs of white (with yellow centre) and highly-fragrant flowers.

P. rubra.—(Red).—A tree similar to the latter, but of a less spreading habit, bearing bright crimson flowers. It is a native of

Central America, and was first introduced at Peradeniya in 1900. Very showy, and remains in flowers for several months.

Poinciana regia. *Leguminosae.*—Flamboyante; Flame Tree; Golden Mohur. A gorgeous tree when in full blossom, bearing immense panicles of scarlet or orange and yellow flowers, native of Madagascar, and introduced into Ceylon before 1841. It is a very striking object in and about Colombo during the months of March to May. The tree grows from 50 to 60 feet in height, and has handsome, fine, feathery leaves. Suited to moist as well as dry regions, especially near the sea.

Posoqueria longiflora. *Rubiaceae.*—A moderate-sized quick-growing tree, with large deep-green leaves, native of Tropical America. It produces long, tubular, white and sweet-scented flowers, borne in pendulous clusters during May and September. Suited to moist districts up to 2,000 feet.

Pterocarpus echinatus. *Leguminosae.*—A moderate-sized tree, native of the Philippines, introduced at Peradeniya in 1882; bears large racemes of pale-yellow flowers at the ends of the branches, during April or May. Very ornamental when in blossom. Suited to the low-country.

Saraca declinata. *Leguminosae.*—A small tree, native of Sumatra, introduced at Peradeniya in 1870. It forms a beautiful sight when bearing its huge heads of bright orange-yellow flowers, produced on the stems and older branches, during February and March. Thrives best in partial shade in the moist low-country.

S. indica. (Indian); "Diya-ratmal," or "Diya-ratambala," *S.*—A small, spreading tree, native of Ceylon and South India. On the stems and branches are produced, chiefly in the dry weather, large sessile clusters of sweet-scented flowers, which change from yellow to orange and red. The young leaves are in long pendulous clusters, as in Brownea and Amherstia. Thrives in shady situations, especially near water, in the wet or semi-dry districts below 1,500 feet.

Schizolobium excelsum. *Leguminosae.*—A very large, quick-growing tree, with fine bi-pinnate, feathery leaves, native of Brazil. Introduced in 1872 at Peradeniya, where it luxuriates, blossoming and producing fruits regularly. The flowers are borne in very large erect racemes, of a bright-yellow colour, during February or March, when the tree is quite bare of leaves. The flowers are at once followed by beautiful feathery young foliage. Thrives up to 1,500 feet in the moist region.

Solanum macranthum. *Solanaceae.* "Potato-Tree."—A medium-sized, quick-growing and soft wooded tree of Brazil, reaching a height of 40 to 50 feet, first introduced into Ceylon in 1844. It is a handsome object when in full blossom, the large blue and white flowers, with conspicuous yellow anthers, being produced at most seasons of the year, but more especially after the dry weather. The large prickly leaves also render the tree very ornamental. Thrives best in partially shaded situations, at elevations below 3,000 feet. This is the only species of the Potato order that grows into a tree form.

Spathodea campanulata. *Bignoniaceae.*—A tall, erect tree from Western Tropical Africa, introduced into Ceylon in 1873, and now fairly commonly planted about Kandy and elsewhere as an ornamental shade-tree. Its large, bright orange-red, erect flowers, produced at the tips of the branches throughout the wet season, render it strikingly handsome and conspicuous at a distance. The unexpanded flowers contain a quantity of water, hence it has been called the "Fountain-Tree." It thrives up to 1,500 feet.

Stenocarpus sinuatus. *Proteaceae.* "Fire Tree," or "Tulip Tree" of Queensland.—See *Flowering Trees for Up-country.*

Sterculia colorata. *Sterculiaceae.* "Malaiparutti," *T.*—A moderate-sized tree, reaching a height of 40 to 50 feet, indigenous to the dry region of Ceylon, but thrives also in moist districts. The brilliant orange-scarlet flowers, appearing in great profusion when the tree is leafless (February to March at Peradeniya), render the tree a conspicuous and handsome object. The Veddas (aboriginals of Ceylon) call the tree "Kenawila," and sing odes to it.

Stereospermum xylocarpum. *Bignoniaceae.*—"Padri-tree" of India.—A large, spreading tree, with small pinnate leaves, native of South India, deciduous for a short period in the dry weather. It bears for a week or two a profusion of white, bell-shaped flowers. Thrives up to 1,500 feet.

Tabebuia spectabilis. *Bignoniaceae.*—A small tree of Venezuela and the West Indies, introduced at Peradeniya in 1881. For a short period, in March or April, when bare of leaves, the tree is an exceedingly beautiful sight, being literally covered with masses of bright-yellow flowers, which as they drop form a golden carpet on the ground. Thrives at Peradeniya (1,500 feet), but as yet only rarely produces seed here.

ORNAMENTAL FOLIAGE TREES

Selection Suitable for Low or Medium Elevations

Agathis (Dammara) robusta. *Coniferae.* Kauri Pine.—A tall, stately tree with a round top, native of Queensland, introduced in 1865 to Peradeniya, where some very fine specimens may now be seen. The tree bears cones occasionally here, but has not yet produced fertile seed. Thrives from 1,500 to 5,000 feet or higher.

A.—Agathis robusta. KAURI PINE.
B.—ARAUCARIA COOKII.

Ailantus excelsa. *Simarubaceae.* "Tree of Heaven."—A large, handsome, quick-growing tree, with long pinnate leaves (3 to 4 feet long), native of India, etc. A striking species for landscape effect. Propagated by seed.

Araucaria Bidwillii. *Coniferae.* Bunya-bunya Pine; "Monkey-puzzle."—A tall tree of Queensland, said to attain a height of

200 feet in its native country, introduced at Peradeniya in 1848. It bears branches down to near the ground; the small leaves are stiff and closely set, ending in a sharp point, hence the name "Monkey-puzzle." Thrives, but does not bear fruit, at Peradeniya.

BREADFRUIT TREE. *Artocarpus incisa.*

A.—Cookii.—A very tall conical tree, with short, slender, horizontal branches, native of New Caledonia, introduced at Peradeniya in 1865. Here it has so far reached a height of about 135 feet; but does not produce fertile seed.

A.—Cunninghamii. Moreton-Bay-Pine.—A tall handsome tree of Eastern Australia and New Guinea, established at Peradeniya since 1848. It is distinguished from *A. Cookii* by its more spreading and horizontal branches and pyramidal shape. Not fruitful at Peradeniya.

Artocarpus Canoni (=A. laciniatus). *Urticaceae.*—A medium-sized tree of the Society Islands. The large oblong leaves are of a striking purplish bronze colour, especially in the young state, on account of which small plants are sometimes cultivated for ornamental purposes in hot-houses. Introduced at Peradeniya in 1906.

A.—incisa. *Urticaceae.* Bread-fruit; "Rata-del" *S.*—A beautiful quick-growing tree, with very large, palmately-cut, shining leaves, native of Malaya and Pacific Islands. It grows to a height of 50 to 60 feet, and few trees present a more noble appearance. Propagated by suckers, rarely from seed. See under *Tropical Fruits.*

A.—nobilis. Wild-Breadfruit; "Del" *S.*—A noble spreading tree, with wavy or crinkled, rigid, oval leaves, peculiar to the moist low-country of Ceylon. It is of rather slow growth, but usually attains a height of 40 to 60 feet, sometimes with an enormous trunk. Propagated by seed.

Axinandra zeylanica. *Lythraceae.* "Kekiri-wara" *S.*—An ornamental tree, about 30 feet high, with a straight trunk, bearing numerous short drooping branches almost to the base; the handsome leaves are 7 to 10 inches long. Peculiar to the moist low-country forests of Ceylon.

Barringtonia speciosa. *Myrtaceae.* "Mudilla" *S.*—A medium-sized, handsome spreading tree, with large leathery shining leaves, producing large white flowers; the latter consist chiefly of a bunch of numerous long white stamens, and are followed by a large quadrangular one-seeded fruit, which, owing to its thick fibrous covering, is an excellent example of floating fruits, being commonly found floating in lagoons, rivers, etc. The tree is indigenous to the sea-shore, and is often planted for ornament. Propagated by seed.

Casuarina equisitifolia. *Casuarineae.* She-Oak; Beef-wood; "Kassa-gaha" *S.*—A lofty quick-growing tree, with fine cord-like branchlets instead of leaves, native of Northern Australia. It is specially adapted to the sea-coast, but also thrives inland up to about 2,000 feet elevation, flourishing in dry or wet region

It has been largely planted in South India for fuel and for reclaiming sandy sea-shores, becoming in some places quite naturalised. The tree is of an ornamental character, especially when young, and is grown in temperate countries as a hot-house plant for decorative purposes. Propagated by seed.

Carapa guianensis. *Meliaceae.* Carapa, or Andiroba Tree.—A quick-growing tree, 60 to 80 feet high, with handsome pinnate

CANNON-BALL TREE. *Couroupita guianensis.*

leaves, composed of eight to ten pairs of shining leaflets. Thrives at Peradeniya, and is suited to the low-country generally.

Columbia javanica. *Tiliaceae.* A tall, stately tree, 80 to 100 feet high, with smooth bark and large oval tomentose leaves, native of Java; flourishes up to 1,500 feet elevation in the moist region. Blossoms in August and January, the flowers being small and dull-yellow.

Cyathocalyx zeylanicus. *Anonaceae.* "Kekala" or "Ipetta," S.—A tall, quick-growing tree, with a straight erect stem and slender graceful branches, native of the moist low-country of Ceylon. Leaves 6 to 10 inches long; fruit large, 2½ to 3 inches long, ovoid in shape, yellow when ripe. Propagated by seed.

Dillenia indica. *Dilleniaceae.* "Hondapara" or "Wampara," S.—A very handsome, moderate-sized, round headed, symmetrical

MONUMENT ROAD, PERADENIYA GARDENS.

tree, native of Ceylon, India and Malaya. It is characterized by large oblong, glabrous, serrate leaves, which are 10 to 12 inches long. Fruit very large, globular, 5 to 7 inches in diameter. See under *Tropical Fruits.*

Dimorphandra Mora. *Leguminosae.* "Mora-tree" of British Guiana.—A large handsome tree, introduced to Peradeniya in 1881. Noted for its excellent timber and immense seed.

Duabanga moluccana. *Lythraceae.*—A handsome tree, attaining about 100 feet in height, with very long graceful, drooping, slender and brittle angular branches, bearing large shining leaves. It is a native of the Moluccas, and has been introduced in 1852 to Peradeniya, where it forms a striking object.

Durio zibethinus. *Malvaceae.* Durian.—A noble tree of pyramidal symmetrical habit, attaining a height of 80 to 100 feet or more. (See under *Tropical Fruits.*)

Enterolobium cyclocarpum. *Leguminosae.*—A tall erect tree with handsome feathery foliage, native of Venezuela, introduced at Peradeniya in 1884. Bears curious circular twisted pods in the dry weather. Propagated by seed.

Erythrina Parcelli. *Leguminosae.*—A small, soft, quick-growing tree with handsome variegated foliage, the leaves being marked by a creamy-yellow band running along the main veins and centre. Native of South Sea Islands. Propagated by cuttings; easy of cultivation, up to 3,000 feet.

Eucalyptus alba. *Myrtaceae.* A large tall slender tree with smooth white bark and drooping foliage. One of the few Eucalypti which flourish in the low-country; it is especially adapted to the semi-dry region, thriving and fruiting at Anuradhapura.

Ficus Benjamina. *Urticaceae.* "Java Fig" or "Java Willow."—A very large spreading tree, with graceful feathery branches and small ovate leaves. It is indigenous to Malaya, and has been introduced at Peradeniya in 1861.

F.—Canoni. See *Artocarpus Canoni.*

F.—Cunninghamii. Queensland Fig. A very graceful spreading tree, with long drooping branches and small oval leaves; very effective for lawns or parks.

F.—elastica. Rambong, or India-rubber tree.—A very large, handsome spreading quick-growing tree, attaining a height of over 100 feet, with large oval leathery shining leaves, native of Assam, Burma and Malaya, introduced into Ceylon about 1835. A very remarkable tree on account of its ærial buttressed roots. (See under *Rubber.*)

F.—regia. A tall erect tree, with smooth white bark and large leaves, bearing a profusion of large fig-like fruits on the trunk and branches; native of Burma, Malaya, etc.

Filicium decipiens. *Burseraceae.* "Pehimbiya" *S.*—A medium-sized or large tree, of rather slow growth, with remarkably handsome fern-like foliage, as its name implies. It is a native of Ceylon, and produces in April quantities of soft vegetative seed, which are of short vitality. Sometimes cultivated as an ornamental pot-plant.

Kigelia pinnata. *Bignoniaceae.* "Sausage Tree."—A tall or moderate-sized spreading tree of Tropical Africa, bearing large pinnate leaves, and long-stalked panicles of flowers. Its remarkable

RAMBONG, OR INDIA-RUBBER TREE. *Ficus elastica.*

oblong grey fruits are suspended by a strong cord-like stalk, hanging thus from the tree, dangling in the air, for several weeks; each fruit is 15 to 20 inches long by 3 to 4 inches in diameter. In Nubia, the tree is held sacred by the Negroes.

Magnolia sphenocarpa. *Magnoliaceae.* Evergreen Magnolia. —A moderate-sized spreading tree, with very large shining, tapering leaves, the latter being 8 to 16 inches long; native of the Eastern Himalayas, thrives at medium elevations in Ceylon, having been long established at Peradeniya.

Mesua ferrea. *Gulliferæ.* Iron-wood Tree; "Na-gaha" *S.*, "Naka" *T.*—A moderate-sized much-branched tree of pyramidal shape and very handsome appearance, native of the moist low-country forests of Ceylon. The young leaves are of a deep crimson, passing through delicate shades of pink into the dark-green of the adult growth. The tree is a slow grower. (See under *Flowering Trees).*

SAUSAGE TREE. *Kigelia pinnata.*

Myroxylon Balsamum. *Leguminosae.* Balsam of Tolu.—A large handsome erect tree, of Tropical America, attaining a height of 70 to 100 feet, with small pinnate, dark-green leaves. Good for roadsides, timber, and fuel. Thrives in rather dry districts, as at Anuradhapura. The fruit, consisting of a lance-shaped one-seeded pod, is produced usually in June and December. Introduced into Ceylon in 1870.

Ostodes zeylanica. *Euphorbiaceae.* "Wal-kekuna" or "Olupetta" *S.*—A very handsome tall tree with smooth bark and large numerous leaves, the latter being 6 to 12 inches long;

indigenous to the moist low-country, up to 1,000 feet. Flowers strongly scented.

Palms. See under *Palms.*

Pandanus furcatus. *Pandanaceae.* Screw-pine.—A large handsome species, 30 to 40 feet high, with long, prickly leaves, which are arranged on the stem in the remarkable form of a screw.

SCREW PINE. *Pandanus furcatus.*

P.—Leram. Nicobar Islands Bread-fruit.—A striking species of Screw-pine, with the stem repeatedly forked, bearing immense heavy, green fruits ; introduced at Peradeniya in 1883.

Pangium edule. *Bixaceae.* "Kapayang" or Pangi (Malay).—A quick-growing, spreading tree with very large heart-shaped leaves, bearing large oval reddish-brown fruits, about 6 inches long ; native of Malaya, and introduced to Peradeniya in 1891. The fruit is considered poisonous, but edible when cooked.

Parkia Roxburghii. *Leguminosae.*—A huge and remarkably handsome quick-growing tree, attaining a height of 120 feet or more, with a clear smooth trunk, and beautiful fine feathery pinnate leaves. It is indigenous to Malaya, Burma, etc.; has been introduced into and become well established in Ceylon, thriving in the moist low-country up to 2,000. feet. The tree flowers in

CANDLE TREE. *Parmentiera cerifera.*

November to December, and bears fruit in February to March, producing clusters of long pods, which contain a quantity of white powdery farinaceous substance. Easily propagated by seed.

Parmentiera cerifera. *Bignoniaceae.* Candle Tree.—A small tree of Tropical America, with small light-green leaves, suggesting those of the Birch. It bears very remarkable candle-like yellow fruits, produced on the stem and branches in great profusion

twice a year, during the drier months. These closely resemble the old-fashioned candles of shops. Propagated by seed.

Pisonia morindifolia. *Nyctagineæ.* Lettuce Tree; "Watabanga Kola" *S.* "Lechchai Kedda" or "Chandi" *T.*—A small tree with very striking pale-yellow foliage, much cultivated on the sea coast, to which it is specially adapted. Propagated by cuttings. The leaves are edible, and cattle are fond of them.

Pithecolobium (Inga) Saman. *Leguminosae.* Rain tree; Guango; Saman Tree; "Peni-karal" *S.*—This large spreading, quick-growing tree is too common in Ceylon to need description, being commonly planted throughout the Island as a shade tree for public and private roads, etc. It was first introduced from South America into Ceylon, through Peradeniya, about 1850. The tree is easily propagated from seed, the season for which is usually from March to May. The brown pods are about 5 to 7 inches long and contain a quantity of sweet sugary pulp, which cattle relish, and are exported from South America as a cattle food. The small pinnate leaves have the habit of closing at night. The supposed property possessed by the tree of producing rain is mythical, and is probably derived from the excretion of moisture sometimes produced on the leaves by means of insects.

Podocarpus cupressina. *Coniferae.*—A small or medium-sized ornamental evergreen tree, with fine graceful feathery foliage, native of Malaya, introduced at Peradeniya in 1880.

Pometia eximia. *Sapindaceae.* "Gal-mora" or "Bulu-mora," *S.*—A handsome tree with a straight erect trunk and large spreading head, native of the moist low-country of Ceylon up to about 1,500 feet; also indigenous to Malaya, etc. Grows to 80 or 100 feet in height. Seeds in July and August.

Pterocarpus echinatus. A handsome foliage tree. (See under *Beautiful Flowering Trees.*)

P.—indicus. *Leguminosae.* "Padouk."—A very handsome huge tree of Burma, with a spreading round head, long drooping branchlets, and small pinnate leaves; bears a profusion of yellowish, sweet-scented flowers in March or April, followed by circular button-like pods.

Ravenala madagascariensis. *Scitamineae.* Travellers' Tree. —A unique and remarkable looking tree of Madagascar, introduced at Peradeniya before 1824. It thrives best in a hot and humid

climate, and attains a height of 30 to 40 feet, assuming approximately the shape of a gigantic fan. The immense distichous leaves are 12 to 15 feet in length and, like the Banana tree of the

TRAVELLERS' TREE. *Ravenala madagascariensis.*

same family, are invariably torn into ribbons by the wind; but this does not detract from their gracefulness. The name "Travellers' Tree" is on account of the capacity of the tree for storing

up water in the receptacles formed by the sheathing bases of the leaf-stalks, being thus supposed to be of service to travellers in deserts. The supposition, however, is rather discounted by the fact that the tree does not naturally grow in districts where water is scarce, and thrives only in regions where the rainfall is more or less abundant. Moreover, during the dry weather the water collected in the leaf-bases referred to becomes putrid and infested

THE PALM DRIVE, PERADENIYA GARDENS.

with the larvæ of mosquitoes and other insects. Propagated by seed or root-suckers.

Schinus.—See *Foliage Trees for Up-country.*

Sandoricum indicum. *Meliaceae.* "Santol."—A tall erect quick-growing tree, with handsome pinnate leaves, native of Malaya, introduced into Ceylon in 1852. (See *Tropical Fruits*).

Schizolobium excelsum. *Leguminosae.*—A large quick-growing tree, with spreading branches and very graceful large feathery leaves, which are finely bi-pinnate. Thrives up to 1,500 feet, and flowers in the dry weather, bearing seed in June. (See under *Beautiful Flowering Trees*).

Swietenia mahogani. *Meliaceae.*—The mahogany tree, noted for its superior wood, native of tropical Central America, and introduced into Ceylon about 1840. It thrives best in the drier climate of the north of the Island, where it often produces seed. It is found to thrive in various parts of India, sometimes producing seed freely. The fine pinnate leaves and ever-green foliage render the tree worthy of growing for shade or ornament.

Swietenia macrophylla.—A handsome upright tree, also of Tropical America, distinguished from the latter species by its larger pinnate leaves; it is also a more rapid grower than the ordinary Mahogany, and is suited to a moist climate, thriving up to 2,000 feet. The discovery of this species and its introduction to the East were due to an accident, chance seeds being received with others and sown at the Botanic Gardens, Calcutta; the seedlings, on being discovered, were watched and on reaching maturity were found to be a new species, which was named by KING as above.

Terminalia belerica. *Combretaceae.* "Bulu," *S.*—A huge, handsome tree, with straight, often buttressed, trunk and long horizontal branches, native of the moist low country, also of India and Malaya; often planted for use or ornament.

T.—Catappa. Country or Indian Almond; "Kotamba" *S.*—A medium-sized tree with large handsome shining leaves, native of Malaya, but now grown in most tropical countries. Its greatest disadvantage is that it sheds its leaves twice a year, causing a litter on the ground for a considerable time. (See under *Tropical Fruits*).

Trevesia palmata. *Araliaceae.*—A small, sparsely branched tree, with expansive palmate or digitate leaves. The young leaves, in a radiating crown at the top, are of a striking dark crimson.

Trichadenia zeylanica. *Bixaceae.* "Tolol" or "Titta-tolol," *S.*—A large tree with very handsome foliage, the oblong or oval leaves being 6 to 12 inches long, borne on long slender branches. Peculiar to the moist low-country of Ceylon.

Vateria acuminata. *Dipterocarpaceae.* "Hal," *S.*—A large handsome tree, with spreading branches and a round head. Leaves

leathery and oblong, 6 to 10 inches long. Fruit large, pear-shaped. Peculiar to the moist low-country of Ceylon, up to 2,000 feet. Propagated by sowing the large one-seeded fruits. The bark is commonly used for retarding fermentation of palm-toddy.

CHAPTER XVI.

SELECTIONS OF ORNAMENTAL PLANTS SUITABLE FOR LOW AND MEDIUM ELEVATIONS

FLOWERING SHRUBS, ETC.

[C.=cuttings. S.=seeds. Div.=division].

Name and Native Country [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Acalypha Sanderi. New Guinea	*Euphorbiaceae*	Rose-pink	C	3—5 Fl's in long tails.
Acokanthera spectabilis. "Arrow poison." S. Africa	*Apocynaceae*	White, scented	,,	6—8 Poisonous
Adhatoda cydoniæfolia. Braz	*Acanathaceae*	White & Purple	S or C	5—6
Allamanda Schottii Brazil	*Apocynaceae*	Yellow	,,	3—4
Alstonia sericea. Java	,,	White	,,	3
Aphelandra Facinator. Colombia	*Acanthaceae*	Scarlet	,,	5—6
A.—tetragona. Colombia	,,	,,	,,	6—7
Ardisia crenata. China	*Myrsineae*	White	S	2—3 Handsome scarlet berries
Asclepias curassavica. W. Indies	*Asclepiadeae*	Orange	S or C	4
Asystasia chelonioides. Ceylon and S. India	*Acanthaceae*	Reddish purple	,,	4
Baccharis rhexioides.	*Compositae*	White	,,	4
Banisteria fulgens. W. Indies	*Malpighiaceae*	Yellow	C	6
B.—laurifolia.=Stigmaphyllon periplocæfolium.				
Barleria cristata alba. India, Malaya, etc.	*Acanthaceae*	White	,,	4
B.—cristata bicolor. India, Malaya, etc.	,,	White & pink	,,	4
B.—cristata rosea.	,,	Pink or rose	C or S	4
B.—Gibsoni. India	,,	Purple	C	3—4
B.—strigosa. India	,,	Pale-blue	C or S	3
Bauhinia candida. India, etc.	*Leguminosae*	White	S	4—5
Beloperone nemorosa. Jamaica	*Acanthaceae*	Pink	C or S	4—5
B.—oblongata. Brazil	,,	Rose-pink	,,	4—5
Brunfelsia americana. Trop. America	*Solanaceae*	Pale-yellow	,,	5—7
B.—uniflora. Brazil	,,	Blue & white	,,	4—6 Scented

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Byrsonima ligustrifolia. S. America	*Malpighiaceae*	Orange-red	S	8—12
Cæsalpinia pulcherrima. W. Indies, etc.	*Leguminosae*	,,	,,	5—6
Calliandra haematocephala.	,,	Pink	,,	5—6
C.—Tweedii Brazil	,,	,,	,,	5—6
Capparis zeylanica. Ceylon	*Capparidae*	White & red	,,	6—7
Cassia alata. Tropics	*Leguminosae*	Yellow	,,	6—8
C.—auriculata. Ceylon and India	,,	,,	,,	6—8
C.—corymbosa. S. America	,,	,,	,,	4—5
Cestrum fasciculatum. Mexico	*Solanaceae*	Purplish-red	S or C	5—6
Chiococca racemosa W. Indies	*Rubiaceae*	White	,,	5—6
Clavija ornata. S. America	*Myrsinae*	Orange-red	S	8—15 Fl's borne on stem.
Clerodendron fragrans. Japan	*Verbenaceae*	White	C	3—4 Fl's scented, double; large leaves, nat. in Ceylon.
C.—inerme. Ceylon & India	,,	White, tipped red	C or S	3
C.—infortunatum. Ceylon, India, Malaya, etc.	,,	White	C	4—10 Fl's scented.
C.—macrosiphon. Zanzibar	,,	Snow-white	,,	3
C.—Minahasse. Celebes	,,	White	C or S	6—8
C.—nutans. Assam, etc.	,,	,,	,,	5—6
C.—paniculatum. Java	,,	Scarlet	C	5—6 Large terminal panicle.
C.—serratum. "Kenhenda," *S*	,,	Blue	,,	5—7 Large fl's.
C.—Siphonanthus. India	,,	,,	,,	4—6 Naturalised in Ceylon.
C.—squamatum. Japan	,,	Scarlet	,,	6—8
Clitoria cajanaefolia. Malaya & Trop. America	*Leguminosae*	Pink	,,	4—5
Costus speciosus. Ceylon, India, etc.	*Scitamineae*	White, yellow centre	Div.	6—9
Crossandra undulaefolia. Ceylon, India, etc.	*Acanthaceae*	Orange-red	S or C	1—2
Crotalaria laburnifolia. "Yakberiya," *S.*	*Leguminosae*	Pale-yellow	S	2—4
Cystacanthus turgidus. Cochin China	*Acanthaceae*	Spotted-purple	C or S	5—6
Daedalacanthus nervosus. N. India	,,	Deep blue	C	4—5
Datura chlorantha, fl. pleno.	*Solanaceae*	Yellow	C or S	6—8 Fl's double.
D.—fastuosa. "Attana," *S.* Ceylon, India, etc.	,,	Bluish-white	,,	2—3
D.—Stramonium. Thorn Apple	,,	White	S	2 } Naturalised in Ceylon.
D.—(Brugmansia) suaveolens. Trumpet Flower	,,	White, scented	C or S	10—15 }
Dombeya Mastersii. Trop. Africa	*Sterculiaceae*	Cream	,,	5—6

S.=Sinhalese

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
D.—natalensis. S. Africa	*Sterculiaceae*	Cream	C	4—5
Duranta Plumieri. S. America	*Verbenaceae*	Blue	C or S	
D.—Plumieri alba.	,,	White	,,	8—15
Ecbolium Linneanum, Ceylon, S. India, etc.	*Acanthaceae*	Light blue	,,	3
Eranthemum cinnabarinum. Burma	,,	Terra-cotta	C	5
Erythrochiton brasiliensis. Brazil	*Rutaceae*	Bright red	S	5
Euphorbia pulcherrima. (=Poinsettia). Mexico	*Euphorbiaceae*	Scarlet-bracts	C	8—10
E.—heterophylla. S. America	,,	Bracts pink at base	S or C	2—3
Francisia bicolor. See Brunfelsia bicolor.				
Galphimia glauca. Mexico	*Malpighiaceae*	Bright-yellow	S	4—5
Gardenia florida. "Cape Jasmine." China & Japan	*Rubiaceae*	White	C	4—6
Goethia strictiflora. Brazil	*Malvaceae*	Orange-red	S	6—7 Fl's borne on stem.
Goldfussia rubescens.	*Acanthaceae*	Blue	C	3—4
Gomphia decora. Brazil	*Ochnaceae*	Bright-yellow	S or C	4—5
Hedychium angustifolium. Ceylon, Assam, etc.	*Scitamineae*	Bright-red	Div.	4—5
Heeria macrostachya. Mexico	*Melastomaceae*	White	C	4—5
Helicteres Isora. "Liniya" S. Ceylon, India, etc.	*Tiliaceae*	Brick red	,,	5—6
Hibiscus mutabilis, alba. China	*Malvaceae*	White	C or S	5—6
Hibiscus mutabilis rosea.	,,	Pink	C	5—6
H.—rosa-sinensis. "Shoe-flower" India	,,	Scarlet	,,	8—15
H.—schizopetalus. Trop. Africa	,,	Orange-red	,,	8—10
Holarrhena antidysenterica. "Conessi Bark". India, Malacca	*Apocynaceae*	White	C	4—5 Fl's scented.
Holmskioldia sanguinea. N. India	*Rubiaceae*	Orange-red	C or S	6—8
Humboldtia laurifolia. "Galkaranda" S. Ceylon	*Leguminosae*	White & Pink	S	8—10 Fl's scented. Hollow inter-nodes inhabited by ants
Ixora coccinea. Ceylon, India	*Rubiaceae*	Scarlet	C or S	4—5
I.—Fraseri. Hort	,,	Salmon-red	C	4—5
I.—javanica. Java	,,	Orange	,,	5—6
I.—macrothyrsa. Sumatra	,,	Deep-red	,,	4—5
I.—odorata. Madagascar	,,	White & Pink	,,	6—8
I.—Pilgrimi. Hort	,,	White	,,	6—8
I.—rosea Khasia	,,	Rose coloured	,,	4—5
Jacobinia coccinea. Brazil	*Acanthaceae*	Scarlet	C or S	5—6
J.—magnifica. Brazil	,,	,,	,,	5—6

S.=Sinhalese

Memecylon umbellatum. KORA-KAHA, *S.*; PANDIKAYA, *T.*

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Jacquinia ruscifolia. Mexico & W. Indies	*Myrsineae*	Bright-orange	S	6—10
Jasminum revolutum India	*Oleaceae*	Bright-yellow	C or S	4—5
J.—Sambac. Ceylon & India	,,	White	,,	4—5
Jatropha panduraefolia. Cuba	*Euphorbiaceae*	Scarlet	,,	3—4
J.—podagrica. Panama	,,	Orange-red	,,	2—3
Jussiaea suffruticosa. Ceylon, etc.	*Onagraceae*	Yellow	S	2—3
Justicia Betonica. "Sudu puruk." *S.* Ceylon, etc.	*Acanthaceae*	Greenish-white	C or S	3—4
J.—calycotricha. Brazil	,,	Yellow	,,	2—3
Kopsia fruticosa. Burma, Java, etc.	*Apocynaceae*	Pink	C	6—8
Lagerstrœmia indica. "Crepe Myrtle." China, India	*Lythraceae*	Bright-pink	C or S	6—10
Lantana nivea. Trop. America	*Verbenaceae*	White	S	3—4 } Numerous varieties
L.—trifolia W. Indies	,,	Orange-yellow	C or S	3—4 }
Malvaviscus arboreus. S. America	*Malvaceae*	Scarlet	,,	4—6
Medinilla magnifica. Philippines	*Melastomaceae*	Rosy-pink	C	5—6
M.—speciosa. Malaya	,,	Crimson	,,	5—8

S.=Sinhalese

A.—*Montanoa bipinnatifida*. B.—*Montanoa tomentosa*

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
M.—**Teysmannii.** Java	*Melastomaceae*	White	C	5
Melastoma malabathricum. " Maha-bovitiya " *S.* Ceylon, India	,,	Pink	C or S	4—6
Memecylon umbellatum. " Kora-kaha," Ceylon & S. India	,,	Deep blue	S	6—8
Montanoa bipinnatifida. Tree-daisy, Mexico	*Compositae*	White	C	8—12
M.—**tomentosa.**	,,	,,	,,	8—12
Murraya exotica. " Etteriya " *S.* Ceylon, Eastern Tropics	*Rutaceae*	Pure white	S	8—12. Fl's scented.
Mussaenda erythrophylla. Trop. Africa	*Rubiaceae*	Bright scarlet	C	4—6
Myrtus communis. Myrtle. S. Europe	*Myrtaceae*	White	C or S	6—8
M.—**tomentosus.** Ceylon	,,	Rose-pink	,,	3—5

S.=Sinhalese

TREE DAISY. *Montanoa bipinnatifida*

Name and Native Country. [Hort =Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Nerium Oleander. Oleander. Asia Minor	*Apocynaceae*	Bright-red	C	5—8
N.—Oleander alba.	,,	White	,,	4—6
Notonia grandiflora. India	*Compositae*	Yellow	C or S	5—6
Ochna Kirkii. E. Trop. Africa	*Ochnaceae*	Bright-red	,,	3—4

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Osbeckia aspera. "Bowitiya" S. Ceylon & India	*Melastomaceae*	Pink	S	4—5
Oxyanthus natalensis Natal	*Rubiaceae*	White	C	4—5
O.—tubiflorus. W. Trop. Africa	,,	,,	,,	4
Palicourea gardenioides. Mexico	,,	,,	,,	5—6
Paulwilhelmia speciosa. Trop. Africa	*Acanthaceae*	Blue	,,	4—5
Pavetta indica. "Pawatta," S. Ceylon. India	*Rubiaceae*	White	,,	3—4
P.—lanceolata. S. Africa	,,	,,	,,	4—6
P.—madagascariensis. Hort	,,	Pink	,,	1½—2
Pentas carnea. Trop. Africa	,,	,,	,,	2—3
Peristrophe speciosa. Himalaya	*Acanthaceae*	Carmine purple	,,	4
Phlogocanthus thrysiflorus. India, Java	,,	Purple	,,	4—6
Plumbago capensis. S. Africa	*Plumbaginae*	Pale blue	,,	2—4
P.—rosea. "Rat-nitul" S. India	,,	Rose scarlet	C or S	2—3
P.—zeylanica. "Ela-nitul" S. Ceylon, etc.	,,	White	,,	2—4
Plumeria acutifolia. "Temple Tree." Mexico	*Apocynaceae*	Creamy white	,,	8—15 } *See Beautiful Flowering Trees.*
P.—rubra. Trop. America	,,	Crimson	C	8—15 }
Portlandia grandiflora. W. Indies	*Rubiaceae*	White	,,	8—12
Quassia amara. Guiana	*Simarubaceae*	Scarlet	C or S	8—10
Randia maculata. Trop. Africa	*Rubiaceae*	Purplish-white	,,	6—10
R.—macrantha. Trop. Africa	,,	White	C	4—6
R.—Mussænda. S. America	,,	,,	,,	4—6
Ravenia spectabilis. S. America	*Rutaceae*	Pink	,,	3—4
Reinwardtia tetragyna. India	*Lineae*	Yellow	S or Div.	2—4
R.—trigyna. India	,,	,,	,,	2—5
Rhodomyrtus tomentosus. Ceylon	*Myrtaceae*	Bright pink	C	4—5
Rondeletia odorata Mexico	*Rubiaceae*	Pink	,,	4—5
Rondeletia speciosa. S. America	,,	Scarlet	,,	3—4
Russellia juncea. Mexico	*Scrophulariaceae*	,,	,,	3—5
R.—sarmentosa. Trop. America	,,	Pink	,,	4—5
Salvia coccinea. Cent. America	*Labiatae*	Scarlet	,,	2
S.—cœlestina. Mexico	,,	Lilac-blue	,,	2
S.—farinacea. Texas	,,	Blue	,,	1½
S.—splendens. Brazil	,,	Scarlet	,,	3
Sanchezia longiflora. S. America	*Acanthaceae*	Magenta	,,	6—8
Sophora violacea. Ceylon	*Leguminosae*	Violet-blue	S	2—3

S.=Sinhalese

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Stemmadenia bella. Mexico	*Apocynaceae*	Pure-white	C	4—6
Stifftia chrysantha. Brazil	*Compositae*	Yellow	S	10—15
Strobilanthes coloratus. E. Himalaya	*Acanthaceae*	Purple	C	4—5
Stromanthe sanguinea. Brazil	*Scitaminae*	Crimson	Div. or S	3—4
Strophanthus dichotomus. India & Malaya	*Apocynaceae*	White & Purple	C	5—6
Tabernaemontana coronaria. India and Malaya	,,	Pure-white	,,	3—4
Tecoma Stans. W. Indies	*Bignoniaceae*	Yellow	C or S	10—15
T.—velutina. Mexico	,,	,,	,,	8—12
Tephrosia grandiflora S. Africa	*Leguminosae*	Red	S	2
Thespesia tomentosa. Mexico	*Malvaceae*	Yellow	C or S	4—5
Thevetia neriifolia. Trop. America	*Apocynaceae*	,,	C	10—15
Thunbergia affinis. Trop. Africa	*Acanthaceae*	Violet	,,	4—5
T.—erecta. Trop. Africa	,,	Dark-blue	,,	4—5
Thyrsacanthus rutilans. Colombia	,,	Crimson	,,	5—6. Fl's pendulous.
Tithonia diversifolia. Mexico	*Compositae*	Yellow	S	5—6
Uroskinnera spectabilis. Cent. America	*Scrophulariaceae*	Showy mauve	C	2—3
Woodfordia floribunda. Ceylon, India, etc.	*Lythraceae*	Brick-red	,,	5—6
Wormia Burbidgei. Borneo	*Dilleniaceae*	Yellow	,,	8—10
Wrightia zeylanica "Suddu-idda" S. Ceylon	*Apocynaceae*	Snowy-white	C or S	3—5

ORNAMENTAL FOLIAGE SHRUBS, ETC.

Suitable for Low and Medium Elevations.

[C.=cuttings. S.=seeds. Div.=division].

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height in ft. and descriptive notes.
Abroma fastuosa. Trop. Asia	*Sterculiaceae*	C or S	8—12; Large roundish leaves.
Acalypha godseffiana. New Guinea	*Euphorbiaceae*	C	3—4; L. white-margined
A.—illustrus.	,,	C	6—8; L. large, blotched with copper & crimson
A.—marginata. India	,,	C	6—8; Margin of leaf pinkish.
A.—obovata. Hort	,,	C	5—8; L. inverted, oval-shaped
A.—tricolor. Fiji Islands	,,	C	6—10; L. blotched with red & crimson
A.—triumphans.	,,	C	6—8; L. large, crimson & green
A.—willinckii. Hort	,,	C	6—8; L. very large, green blotched with yellow

S.=Sinhalese

Name and Native Country. [Hort =Of garden origin].	Natural Order.	How Propagated.	Height in ft. and descriptive notes.
A.—wilkesiana. Fiji Islands	*Euphorbiaceae*	C	5—6; L. twisted, copper-coloured.
Alchornea ilicifolio. Australia	,,	C	8—10; Holly-like leaves.
Alpinia rafflesiana	*Scitamineae*	Div.	4—5; L. variegated.
Amomum hemisphæricum. Java	,,	S & Div.	6—8; Large handsome herbaceous leaves, rising from base.
A.—magnificum. Mauritius	,,	Div.	10—15; L. bronze tint, very handsome. Fl's in large pink heads on stalks 2 to 3 ft. high.
Aralia filicifolia. Pacific Islands	*Araliaceae*	C	8--10; L. large, pinnatifid, yellow when young.
A.—Guilfoylei. Pacific	,,	C	8–10. Stems erect; L. edged & blotched with white.
A.—maculata. Polynesia	,,	C	8—10. Stems & leaves of purplish hue with green spots.
A.—triloba.	,,	C	Leaves in 3 long lobes.
Arundo Donax variegatum. S. Europe	*Gramineae*	C	5—8 Ornamental variegated grass.
Bambusa. See *Bamboos and Ornamental Grasses*			
Beaucharnia recurvata. Mexico	*Liliaceae*	S	4—6 Dracæna-like plant, stem swollen at base.
Bœhmeria pulchra. Hort	*Urticaceae*	C	5—6; L. velvety dark-green.
Carludovica palmata. Peru	*Cyclanthaceae*	S or Div.	5—7 Panama-hat Plant. Large handsome palm-like leaves.
Chamæranthemum Beyrichii variegatum. Brazil	*Acanthaceae*	C	2—3; L. variegated, ornamental.
Codiæum, or Croton. Malaya, Polynesia, etc. (Numerous varieties).	*Euphorbiaceae*	C	5—8 { Highly ornamental shrubs with variously coloured leaves.
Cordyline (Dracaena) cannæfolia. Australia	*Liliaceae* }	Portions of stem.	6—12 { Very elegant palm-like plants, usually erect and unbranched, many with highly coloured leaves.
C.—Duffii. Polynesia	,,		
C.—Fraseri do	,,		
C.—magnifica do	,,		
C.—terminalis. Malaya, China, etc.	,,		
Cycas circinalis. "Madu" S. Ceylon, India, etc.	*Cycadeae*	S or off-sets.	6—12 } Handsome slow-growing plants, bearing a crown of long pinnate leaves.
C.—Rumphii. Moluccas	,,	,,	6—8
C.—siamensis. Cochin China (Several other species).	,,	,,	4—6
Cyclanthus cristatus.	*Cyclanthaceae*	Div.	5—6 { L. radical, long & plantain-like. Stemless plants.
C.—discolor. Columbia	,,	,,	
Encephalartos Hildebrandti. Zanzibar	*Cycadeae*	S or off-sets.	5—7 { Slow-growing. Cycas-like plants, with long pinnate, spiny leaves.
E.—horridus. S. Africa	,,	,,	

S.=Sinhalese

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height in ft. and descriptive notes.
E.—villosus. (Several other species).	*Cycadeae*	S or off-sets	5—7. Long spiny leaves.
Erythrina Parcellii. Hort	*Leguminosae*	C	6—10; L. variegated, creamy-white.
Excæcaria bicolor. Java	*Euphorbiaceae*	C	4—6; L. small, purple beneath
Goldfussia anisophylla. Himalaya	*Acanthaceae*	C	3—4 Dense bush ; small leaves.
Graptophyllum hortense. "Caricature Plant." Trop. Asia	,,	C	4—5; L. variegated, ornamental.
Heliconia angustifolia. Brazil	*Scitamineae*	Div.	5—6; L. large, plantain-like.
H.—aureo-striata. Solomon Islands	,,	,,	4—5; L. large striated with yellow.
H.—brasiliensis. Lobster claw. Brazil	,,	Div. or S	5—6 Remarkable for large bright-red fruit spikes.
H.—brevispatha. S. America	,,	,,	3—4; L. long and narrow. Fl's white with orange-red spathes.
H.—insignis.	,,	Div.	5—7; L. bright bronze, long, narrow & wavy.
H.—metallica. New Grenada	,,	,,	4—5; L. bronze, drooping.
H.—pulverulenta. S. America	,,	Div. or S	4—5; L. with white powdery substance beneath.
H.—spectabilis.	,,	,,	4—6; L. bright bronze.
Justicia grandiflora.	*Acanthaceae*	C	4—5 Handsome foliage plant.
Leea amabilis. Borneo	*Ampelideae*	C	4—6 } L. pinnate, handsome; veins marked
L.—coccinea. Burma	,,	C	4—5 }
Macrozamia Fraseri. W. Australia	*Cycadeae*	S	4—6 } Handsome fern-like plants, with long feathery graceful leaves.
M.—Moorei. Queensland	,,	S	4—6 }
M.—plumosa. Queensland	,,	S	2—4 }
Miconia flammea. S. America	*Melastomaceae*	C	4—5 } Handsome plants, with large rugose leaves.
M.—Hookeriana. Peru	,,	C	4—5 }
Muehlenbeckia platyclada. Solomon Islands	*Polygonaceae*	C	4—6 Curious straggling shrub, with flattened branches and stems for leaves.
Myriocarpa longipes. Costa Rica & Mexico	*Urticaceae*	C	8—10; L. large oval, rugose & hispid. Fl's in long pendulous threads.
Nandina domestica. China & Japan	*Berberideae*	Div. or S	4—6; L. small, bi-pinnate, tinted red.
Palms. see under *Palms*			
Panax fruticosum. Trop. Asia	*Araliaceae*	C	4—6 Quick-growing ; handsome feathery foliage.
Pandanus Sanderiana.	*Pandanaceae*	Offsets	4—6 } Handsome variegated leaves.
P.—variegatus. Java	,,	,,	6—8 }

1. TRAVELLERS' TREE (*Ravenala madagascariensis*); 2. PANAMA-HAT PLANT (*Carludovica palmata*); 3. NICOBAR BREAD-FRUIT (*Pandanus Leram*).

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height in ft. and descriptive notes.
Pedilanthus tithymaloides. S. America	*Euphorbiaceae*	C	4—6. Erect succulent shrub.
Phyllanthus myrtifolius.	,,	S	5—6 Small myrtle-like leaves
Pisonia alba. "Lettuce Tree." India & Malaya	*Nyctagineae*	C	10—20; L. pale yellow.
Ravenala madagascariensis. "Travellers' Tree." Madagascar	*Scitamineae*	S or Div.	10—20; *See Ornamental Foliage Trees.*
Rudgea macrophylla. Brazil	*Rubiaceae*	C or S	5—6; L. large, obovate. Fl's. cream, in dense heads.
Sanchezia nobilis. Eucador	*Acanthaceae*	C	5—6 { L. large, with white bands.
S.—glaucophylla.	,,	C	
Sesbania aegyptiaca. Trop.	*Leguminosae*	S or C	6—8 L. finely bi-pinnate
Sophora tomentosa ." Mudumurunga." *S.* Ceylon, etc.	,,	S	4—5 Whole plant wooly-white.
Tococa imperialis. Peru	*Melastomaceae*	C	4—6 { Large elliptic, satiny leaves, very handsome.
T.--latifolia. Brazil	,,	C	
Thunbergia Kirkii. Africa	*Acanthaceae*	C	3 ft. Ornamental foliage; square stems.
Vernonia macrophylla. Braz.	*Compositae*	S	6—8 Large ovate leaves.

ORNAMENTAL FLOWERING CLIMBERS

SUITABLE FOR LOW AND MEDIUM ELEVATIONS.

[C.=cuttings; S,=seed ; Tu.=tubers].

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Acridocarpus natalitius. Natal	*Malpighiaceae*	Bright Yellow	C	L. leathery, oblong or obovate.
Adenocalymna nitidum. Brazil	*Bignoniaceae*	Yellow	C	L. trifoliate, tendrilled.
Allamanda cathartica. "Willow-leaved Allamanda." Trop. America	*Apocynaceae*	,,	C	} Quick-growing and free flowering climbers.
A.—Hendersonii. Brazil	,,	,,	C	
A.—Wardleana Hort	,,	,,	C	
Antigonon insigne. Columbia	*Polygalaceae*	Rose-pink	C	{ Elegant climbers, of moderate growth, suited for arbours, verandahs, etc.
A.—leptopus. Mexico	,,	Pink	C or S	
A.—leptopus albiflora.	,,	White	C	
Arauja grandiflora. Brazil	*Apocynaceae*	,,	C	Fl's tubular, scented.
Aristolochia elegans. Brazil	*Aristolochiaceae*	Reddish-purple	S	} Fl's saucer-shaped, very elegant.

S.=Sinhalese

ARISTOLOCHIA PERGOLA, PERADENIYA GARDENS.

Name and Native Country, [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
A.—gigas, var. Sturtevantii. Guatemala	*Aristolochiaceae*	Rich-brown, spotted	C.	"Fly-catcher." Fl's very large, offensive odour.
A.—hians. Venezuela	,,	Spotted-purple	S.	Fl's 2-lobed.
A.—labiosa. Brazil	,,	Purple green, etc.	C. or S.	Large broad lip.
A.—ridicula. ,,	,,	Greenish-brown	S.	Fl's 2-horned.
A.—ringens. ,,	,,	Purplish-green	C.	L. round, light-green
A.—saccata. Himalaya	,,	Purplish-red	C.	Fl's small, throat yellow. L. large, hairy.
Asparagus falcatus. "Hatawariya" S. Ceylon	*Liliaceae*	Creamy-white	S or Tu	Fl's in large panicles, sweet scented.
A.—racemosus. Ceylon	,,	,,	,,	
Beaumontia grandiflora. "Nepal Trumpet-flower." India	*Apocynaceae*	White	C.	Strong grower. Fl's large, tubular.

S.=Sinhalese

Bignonia magnifica.

STRONG GROWING CLIMBER; FLOWERS BRIGHT MAGENTA.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Bignonia magnifica. Columbia	*Bignoniaceae*	Magenta	C.	Vigorous grower, very showy, frequent bloomer.
B.—unguis-cati. Tropical America	,,	Bright-yellow	S. or C.	Fl's profuse, very handsome.
Bignonia venusta. "Tanga poo" *T.* Brazil	,,	Bright-orange	C.	Fl's in dry weather; very elegant.
Bougainvillea glabra. Brazil	*Nyctagineae*	Bright-purple	C or S	Large plant, fl's very showy.
B.—glabra. var. Sanderiana	,,	,,	C	Dwarf variety.
B.—spectabilis, var. laterita. Brazil	,,	Brick-red	C	Straggling shrub, very handsome.

T.=Tamil

GIANT FLY-CATCHER. *Aristolochia Gigas var. Sturtevantii*

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Camoensia maxima. Trop. Africa	*Leguminosae*	White & yellow	C or S	Fl's very large, scented.
Cereus triangularis. "Night-flowering Cactus." W. Indies	*Cactaceae*	White	C	Epiphyte. Fl's large, tubular.
Clerodendron Thompsonæ. Trop. Africa	*Verbenaceae*	White & scarlet	C	Lovely plant, small growth.
C.—speciosum. Hort	,,	Scarlet	C	Very ornamental.
Clitoria ternatea. "Kataroluwel," *S* (Also a white-flowered variety)	*Leguminosae*	Blue	S	Pretty, but not a free bloomer.
Congea tomentosa. Burma	*Verbenaceae*	Delicate pink	C	Fl's in large sprays, lasting several weeks.

S.=Sinhalese

JUNGLE ROPES. *Anodendrum paniculatum.*

Name and Native Country. [Hort.=Of garden origin]	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Cryptostegia grandiflora. Trop. Africa	*Asclepiadeae*	Pink	C.	Climbing shrub, showy.
Dipladenia amabilis. Hort	*Apocynaceae*	Rosy-crimson	C	Very showy climbers, not yet well established in Ceylon.
D.—flava. New Grenada	,,	Yellow	C	
D.—splendens. Brazil	,,	Rose	C	
Gloriosa Rothschildiana.	*Liliaceae*	Crimson & yellow	Tu	Beautiful herbaceous twiners. First named has very large flowers.
G.—superba. "Niyangala," S. Ceylon, Trop. Asia and Africa	,,	Orange & yellow	,,	
G.—virescens. Trop. Africa	,,	Greenish-red	,,	
Hoya carnosa. "Wax Flower." Trop. Asia.	*Asclepiadeae*	Pink	C	Thrives on tree-trunks; medium elevations best.
Ipomœa carnea. Trop. America	*Convolvulaceae*	Light pink	C	Straggling shrub, fl's large.

S.=Sinhalese

SNAKE-LIKE CLIMBER. *Bauhinia anguina.*

Congea tomentosa.
Woody climber ; flowers in large loose sprays, delicate pink.

Gloriosa Rothschildiana. A beautiful herbaceous climber, with rich crimson flowers; superior to *Gloriosa superba* or "Niyangala."

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers	How Propagated.	Descriptive remarks.
Ipomœa Briggsii. W. Indies	*Convolvulaceae*	Crimson	C	Very showy, free bloomer.
I.—Learii. Trop. America	,,	Purplish blue	C or S	Beautiful plant, quick-grower.
I.—palmata. Trop. Africa	,,	Purple	S	Leaves small, palmately divided.
I.—Quamoclit. Tropics	,,	Scarlet	S	Annual; fine pinnate leaves.
I.—tuberosa. "Spanish Arbour Vine." W. Indies	,,	Yellow	S or Tu	Very handsome.
Jacquemontia violacea. Mexico, etc.		Blue	C or S	Annual; free bloomer.
Jasminum flexile. Ceylon	*Oleaceae*	White	C	Scented; trifoliate.
J.—pubescens. India, Burma	,,	Pure white	C	Very fragrant.

Odontadenia speciosa. Woody climber; flowers large, bell-shaped, salmon-yellow, fragrant and showy.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive remarks.
J.—**revolutum.** "Saban-pitcha," S. India	*Oleaceae*	Yellow	C	Climbing shrub.
J.—**sambac.** "Arabian Jasmine." Ceylon, India	,,	White	,,	Fl's strongly scented.
Lonicera Hildebrandiana. Burma	*Caprifoliaceae*	Yellow	,,	The largest-flowered Honey-suckle.
Macrosphyra longistyla. W. Trop. Africa	*Rubiaceae*	Cream	,,	Climbing shrub, long tubular fl's.
Naravellia zeylanica. Ceylon, India, etc.	*Ranunculaceae*	Dingy white		Thrives best on tree trunks.
Nyctocalos Thomsoni. Assam	*Bignoniaceae*	White	,,	Beautiful plant
Odontadenia speciosa. S. America	*Apocynaceae*	Salmon-yellow	L	Fl's fragrant and Showy

S.=Sinhalese

Petrœa volubilis.
Woody climber; flowers in pendulous racemes, bright heliotrope and violet—a lovely plant.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Oxera pulchella. New Caledonia	*Verbenaceae*	Greenish-white	C	A handsome plant
Passiflora cœrulea. Brazil	*Passifloraceae*	Bluish purple	C	Leaves 3-5 lobed
P.—jenmani. Guiana	,,	Creamy-white	C	Very distinct
P.—laurifolia. Trop. America	,,	Red & violet	C	See *Foliage Climbers*
P.—racemosa. Brazil	,,	Scarlet		L. glaucous beneath
P.—violacea.	,,	Pale-lilac	C	A beautiful species
Pergularia odoratissima "Tonkin Creeper" China & Sumatra	*Asclepiadeae*	Greenish-white	S or C	Fl's fragrant. Fruit large and winged
Petrœa volubilis. Trop. America	*Verbenaceae*	Blue & violet	C	A lovely plant

GIANT POTATO-CLIMBER. *Solanum Wendlandii.*

Thunbergia grandiflora.

A quick-growing immense climber ; flowers large, pale blue or mauve.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Porana paniculata. "Bridal Bouquet." India, Java	*Convolvulaceae*	Creamy-white	C	Large plant, handsome when in fl.
P.—volubilis. "Horse-tail Creeper." Malaya	"	Greenish-white	C	Vigorous grower; fl's in large loose panicles
Quisqualis indica. "Rangoon Creeper." S. India, Malaya	*Combretaceae*	Orange-red	C	Flowers in dry weather, very showy
Raphistemma pulchellum. Assam, Burma	*Asclepiadeae*	White	C	L. heart-shaped.
Rhodochiton volubile. Mexico	*Scrophulariaceae*	Bright-red	C	8 to 10 ft. in height
Rose. "Marechal Niel" —See Roses				

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers.	How Propagated.	Descriptive Remarks.
Roupellia grata. "Cream Fruit." W. Trop. Africa	*Apocynaceae*	Purplish-white	S or C	Strong grower. Fl's in dense bunches
Schubertia =Araujа				
Senecio hederæfolia.	*Compositae*	Yellow	C or S	Herbaceous plant with Ivy-like leaves.
Solanum Wendlandii. "Giant Potato Climber." Costa Rica	*Solanaceae*	Bluish-purple	C	Vigorous-grower very showy.
Stephanotis floribunda. Madagascar	*Asclepiadeae*	Pure-white	C	Fl's tubular, scented: very popular. Thrives best in tubs.
Stigmaphyllon ciliatum. Brazil	*Malpighiaceae*	Yellow	C	Showy flowers, but not free bloomers.
S.—periplocæfolium. India	,,	,,	C	
Thunbergia grandiflora.	*Acanthaceae*	Pale-blue or Mauve	S C or Tu.	A quick-growing immense climber; large fl's
T.—grandiflora alba.	,,	White	C	A less robust var. of above.
Tristillateia australis. Malaya, etc.	*Malpighiaceae*	Yellow	C	Handsome free-bloomer; suited to sea-coast.
Wagatea spicata. India	*Leguminosae*	Scarlet	C or S	Vigorous grower; L. pinnate, thorny.

ORNAMENTAL-LEAVED CLIMBERS.

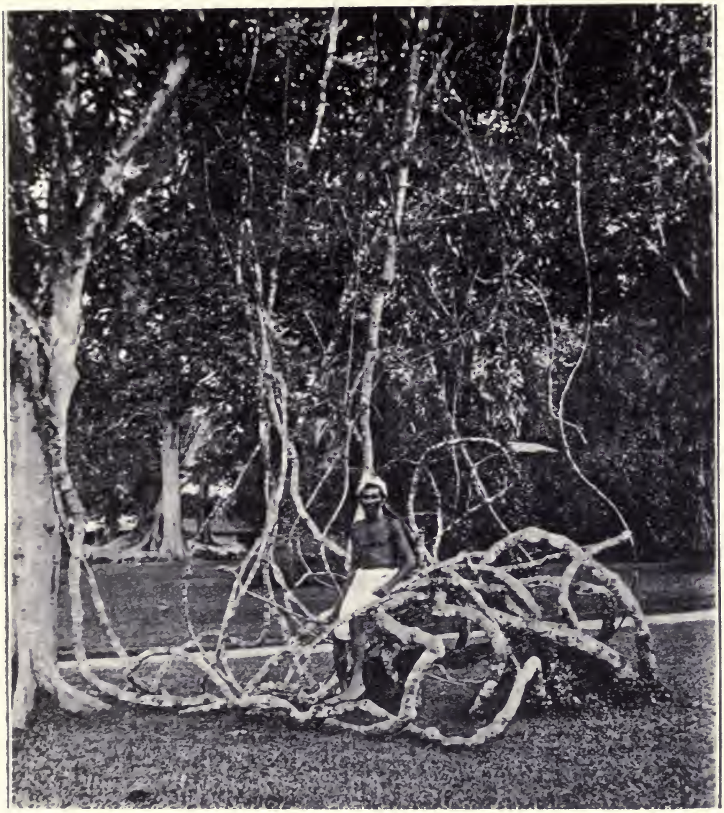
Suitable for Low and Medium Elevations.

[C.=cuttings: S.=seed; Div.=Division: Tu=tubers].

Name and Native Country. [Hort.=Of garden origin]	Natural Order.	How Propagated.	Descriptive Remarks.
Argyreia speciosa. 'Elephant climber." India, Java	*Convolvulaceae*	C or S	Vigorous grower; L. large, silvery underneath. Fl's purple.
Aristolochia leuconeura. Colombia	*Aristolochiaceae*	C or S	White-veined leaves; arbours, &c.
A. trilobata. W. Indies	,,	C	Tri-lobed leaves.
Asparagus plumosus. S. Africa	*Liliaceae*	S or Tu.	Fine fern-like foliage. Suited for growing in pots.
A. Sprengeri Natal	,,	,,	Needle-like leaves. Pot-culture.
Bauhinia diphylla. Malaya	*Leguminosae*	C	L. small, 2-lobed; a straggling shrub.
Bignonia argyreo-violascens. Hort	*Bignoniaceae*	C	L. prettily marked with white or violet veins.
Buddleia madagascariensis. Madagascar	*Loganiaceae*	C	Climbing shrub; l. silky-white beneath.

JUNGLE IN PERADENIYA GARDENS.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Descriptive Remarks.
Cardiospermum Corindum. Ceylon	*Sapindaceae*	S	Small climbers, with finely cut foliage and white fl's.
C.—hirsutum.	,,	S	
Cissus (Vitis) discolor. Java	*Ampelideae*	C	Young leaves beautifully tinted violet & purple. Requires shade.
Echites rubro-venosa. Brazil	*Apocynaceae*	C	L. with pink veins
Geitonoplesium cymosum. Queensland	*Liliaceae*	S or Tu.	L. linear or strap-shaped.
Ipomœa sinuata. Trop. America	*Convolvulaceae*	S	L. deeply cut.
Mimosa argentea. Hort	*Leguminosae*	C	Silvery white midrib.
Nepenthes distillatoria. Pitcher Plant. Ceylon.	*Nepenthaceae*	C. div., or S.	Leaf-tips formed into "pitchers." Moist shady situation.
Passiflora laurifolia. Trop. America.	*Passifloraceae*	C	L. ovate entire; excellent plant for screens, etc.

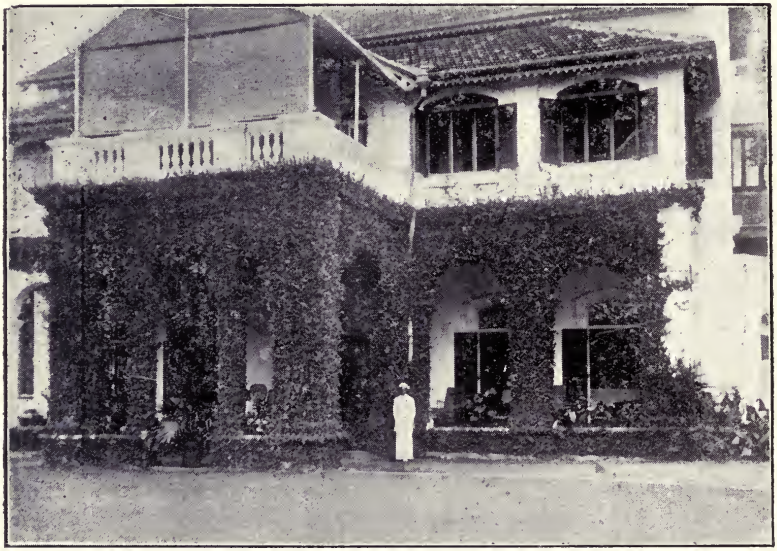


Salacia reticulata. "HIMBUTU-WEL."

Name and Native Country [Hort.=Of garden origin]	Natural Order.	How Propagated.	Descriptive Remarks.
P.—trifasciata. Brazil	*Passifloraceae*	C	L. variegated, purplish beneath
Paullinia thalictrifolia. Brazil	*Sapindaceae*	C	A small plant with fine fern-like leaves.
Smilax argyræa. Bolivia	*Liliaceae*	C	L. spotted white ; prickly stems
S.—officinalis. Columbia	,,	C	Large shiny oblong leaves, prickly stems
Vitis incisa. Texas	*Ampelideae*	C	Leaves much cut
V.—voinerriana. Tonkin	,,	C	L. large, thick, trifoliate, hairy

CREEPERS.

In the tropics, there is generally a lack of ornamental creepers. The Ivy, which forms so delightful an adornment to gardens and houses in temperate countries, does not thrive in tropical regions, even at the higher elevations. Yet few buildings, whether bungalows,



FICUS PUMILA. A good substitute for Ivy in the Tropics.

stores, churches, etc., which would not be greatly improved in appearance by the growth of a suitable creeper over their walls, more especially in situations which are exposed to the glare of the tropical sun. *Ficus pumila* (better known as *F. repens*) answers this purpose remarkably well, as may be seen from the accompanying illustration. The plant thrives at all elevations, is evergreen, a quick-grower, and readily increased by cuttings, which may be planted *in situ*. It occasionally bears large green oval fruits, which are not edible. The following are a selection of creepers suitable for pots, tree trunks, etc.:—

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Descriptive Remarks.
Ficus pumila. China, Japan, etc.	*Urticaceae*	C	See illustration
Epipremnum mirabile "Tonga-Creeper," Malaya, Fiji, etc.	*Aroideae*	C	Epiphytic creeper, large pinnatifid leaves.
Monstera deliciosa. Mexico	,,	C	A noble vigorous creeper, huge perforated and pinnatifid leaves. See *Tropical Fruits*
Pellionia daveauana. Cochin China	*Urticaceae*	C	Small creepers, variegated leaves, suited for hanging pots and shaded corners
P.—pulchra ,, ,,	,,	C	
Philodendron andreanum. Hort	*Aroideae*	C	Large handsome satiny leaves
P.—erubescens. Venezuela	,,	C	L. coppery beneath
P.—squamiferum	,,	C	Leaves and petioles with glandular pinkish hairs
Pothos argentea. Borneo	,,	C	L ovate, silvery-grey
P.—aurea. "Colombo Agent" Solomon Islands	,,	C	Enormous epiphytic creeper. L. large, oval, yellowish. Moist shady places.
Raphidophora decursiva. "Dada-kehel" S. Ceylon, India, Java	,,	C	L. large pinnatifid; creeper on trees in moist shady places.
R.—pertusa. Malaya, etc.	,,	C	L. smaller than the above, perforated.
Scindapsus argyræa. Philippines	,,	C	L. coriaceous, with silvery spots.

SHOWY ANNUALS AND PERENNIALS.

SPECIALLY SUITED FOR FLOWER-BEDS & BORDERS AT LOW & MEDIUM ELEVATIONS

C.=cuttings. S.=seed. Tu.=Tubers. Div.=division.

Name.	*A.*=Annual *P.*=P'r'nl *Shb.*=Shrub.	How Propagated.	Descriptive Remarks.
Acalypha Sanderiana.	*Shb.*	C	6—8 ft. Fl's in long pendulous scarlet tails.
Achimenes, different varieties	*P.*	S or Tu	1 ft. Tuberous plants, free-flowering and showy.
Ageratum, several varieties	*A.*	C or S	1—1½ ft. Fl's blue.
Alternanthera, green and bronze var's	*P.*	C	½—1 ft. Useful for edging and pattern work.
Amaranthus tricolor, several var's	*A.*	S	2—4 ft. Showy coloured leaves.
Ananas variegata. Variegated Pine-apple	*P.*	Su.	1½—2 ft. Variegated leaves.
Angelonia salicaræfolia.	*P.*	C	2 ft. Fl's bluish-purple, scented.
Arundo Donax variegatus.	*P.*	Div.	6—8 ft. Handsome variegated grass; does best in light sandy soil.

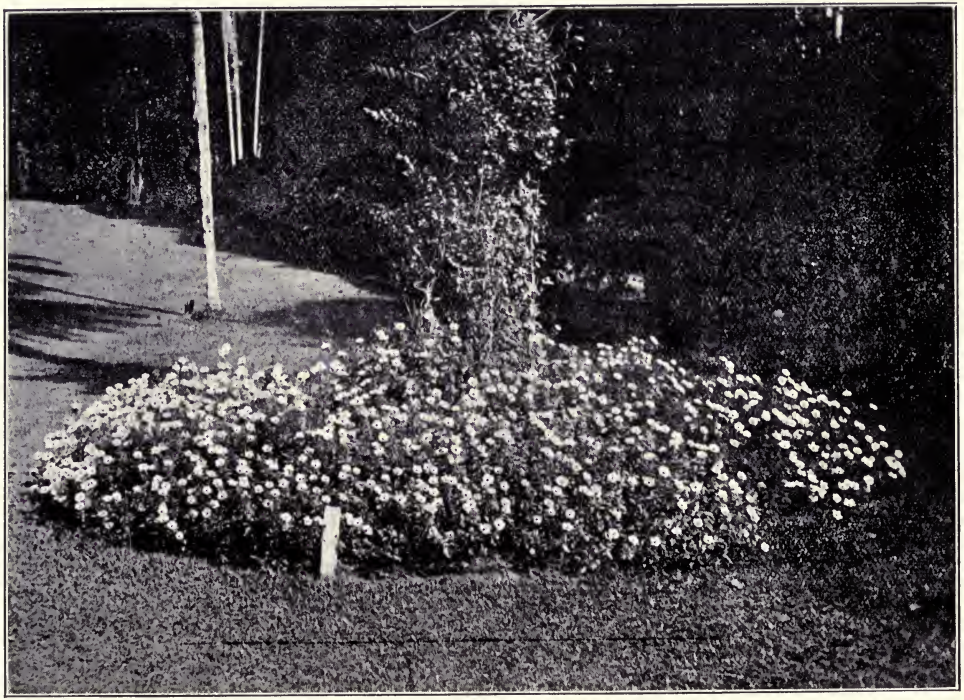
S.=Sinhalese

Name.	A.=Annual P.=P'r'nl. Shb.=Shrub	How Propagated.	Descriptive Remarks.
Aster, China. Numerous var's	A	S	½—1 ft. Numerous shades of pink red, white, etc.
A.—eminens.	P	Div.	1—1½ ft. Fl's pale blue.
Balsam, numerous var's	A	S	½—1 ft. Different shades, very showy.
Bartonia aurea.	A	,,	1½ ft. Handsome yellow fl's.
Begonia, Fibrous-rooted. several var's	P	C	1—2½ ft. Showy fl's, pink shades.
Browallia grandiflora.	P	S	½—1 ft. Fl's dark blue.
Caladium Humboldtii. Numer's other sp. & var's	P	Tu.	6—8 in. L. variegated white. Excellent for edging, designs, etc.
Calendula officinalis.	A	S	1—1½ ft. Fl's orange-yellow.
Candytuft. "White Spiral."	A	,,	1 ft. Fl's pure white, in large heads.
Canna, numerous varieties (See under *Tuberous Plants*)	P	Tu. & Div.	2—4 ft. Various shades of orange yellow, red and pink. Some var's with purple or bronze foliage.
Celosia. "Cock's Comb"	A	S	½—1 ft. Fl's in large heads, crimson, scarlet, etc.
Chrysanthemum, Chinese	P	Div. & C.	1—2 ft. Fl's white, brown, or yellow.
Chrysanthemum, annual; numerous var's.	A	S	1—2 ft. Various colours.
Coleus, several var's	P	C	1½—2 ft. L. beautifully coloured.
Coreopsis grandiflora.	A	S	1 ft. Fl's yellow.
C.—tinctoria.	A	,,	1 ft. Fl's crimson, etc.
Cosmos bipinnatus.	A	,,	2—3 ft. Fl's pink or yellow.
C.—sulphureus.	A	,,	2—3 ft. Fl's orange-yellow.
Dahlia, "Cactus;" "Double" and "Single" var's.	P	Tubers	2—4 ft. Purple, scarlet, yellow, etc.
Dianthus chinensis. Indian Pink. Single and Double var's	A	S	1 ft. Fl's white, pink, scarlet, &c., very showy.
Euphorbia pulcherrima. Poinsettia	*Shb.*	C	4—10 ft. Large brilliant scarlet fl's (bracts), suitable for grouping. Cut back after flowering.
Exacum zeylanicum. "Bindara" S.	A	S	1—1½ ft. Beautiful violet-blue fl's.
Gomphrena globosa. "Globe Amaranth"	A	,,	1 ft. Free flowering; fl's purple, in round heads.
Gynandropsis speciosa.	A	,,	2—3 ft. Handsome pink fl's.
Helianthus annuus, several var's.	A	,,	2—3 ft. Very showy yellow fl's.
Hippeastrum, several var's.	P	Bulbs	1—1½ ft. Fl's large, scarlet, white, etc. Very showy.
Honckenya ficifolia. Trop. Africa.	*A shb.*	S or C	3—5 ft. L. bronze; fl's coppery red.
Impatiens Sultani. "Sultan's lower"	P	C or S	1—1½ ft. Showy scarlet or pink fl's.
Marigold, African. (*Tagetes erecta*)	A	S	1½—2 ft. Fl's lemon-yellow, etc.
M.—French. (*T.—patula*)	A	,,	1 ft. Fl's orange, crimson, etc.
Nasturtium. See *Tropæolum*			

S.=Sinhalese

Gynandropsis speciosa. "SPIDER FLOWER." FLOWERS PALE PINK.

Name.	*A.*=Annual. *P.*= P'r'nl. *Shb.*=Shrub.	How Propagated.	Descriptive Remarks.
Nicotiana, numerous var's	*A.*	S	2—3 ft. Fl's white, pink, etc. Very showy.
Pentas carnea	*P.*	C	2 ft. Delicate pink.
Petunia, numerous var's	*A.* or *P.*	S or C	1—1½ ft. Large showy white, purple, or pink fl's.
Phlox Drummondii. Numerous var's	*A.*	S	1 ft. Beautiful free-flowering plants; fl's different colours.
P.—suffruticosa. Perennial Phlox	*P.*	Div.	1½—2 ft. ,, ,,
Phrynium variegatum.	*P.*	Tu. or Div.	2 ft. Handsome variegated large leaves.
Plumbago capensis.	*Shb.*	C	3 ft. Fl's beautiful delicate blue.
Poinsettia. See *Euphorbia*			
Portulaca, Several var's	*A.*	S	3 in. Brilliant shades of pink, yellow, etc.
Ruellia formosa	*P.*	S	2 ft. Fl's large, bright pink.
R.—macrantha	*P.*	S	2 ft. Rosy purple.
R.—tuberosa	*P.*	S or C	1½ ft. Fl's blue.
Salvia farinacea	*P.*	C or S	1½ ft. Fl's pale-blue.
S.—"Scarlet Queen"	*P.* or *Shb.*	S or C	2—3 ft. Fl's bright-scarlet.
Several other species and var's			



TURNERA ELEGANS.

An attractive, free-flowering perennial

TORENIA FOURNIERI.

Flowers dark-blue and white.

Name	*A.* Annual *P.* P'r'nl. *Shb.* Shrub.	How Propagated.	Descriptive Remarks.
Sedum sexangulare. "Stone Crop."	*P.*	C	3 in. Suitable for edging and rockery.
Sinningia speciosa. Wild Gloxinia	*P.*	Tu.	1 ft. Fl's large, mauve, bell-shaped. Likes shade and rich soil.
Siphocampylus Humboldtii	*P.*	C	1 ft. Fl's scarlet.
Torenia Bailloni.	*A.*	S	½ ft. Fl's yellow.
T.—Fournieri	*A.*	S	½ ft. Fl's dark-blue and white.
Tropaeolum, dwarf and climbing var's	*A.*	S or C	Fl's orange and yellow; require dry shady place.
Turnera elegans	*P.*	C or S	1½—2 ft. Fl's creamy white, closing in sun: free bloomer.
Uroskinnera spectabilis	*Shb.*	C	2—3 ft. Fl's mauve, very showy.
Verbena venosa. Several var's	*P.*	C or S	1 ft. Fl's pinkish-purple, very showy.
Vinca rosea alba	*P.*	"	2 ft. Fl's pure white.
V.—oculata-rubra	*P.*	"	2 ft. Fl's white with pink centre.
Zinnia linearis.	*A.*	S	1 ft. Fl's orange-yellow.
Z.—"Fireball." Numerous var's	*A.*	S	1—2 ft. Free-flowering, scarlet, pink, yellow, etc.

ORNAMENTAL BULBOUS OR TUBEROUS PLANTS

Suitable for Growing in Pots or Shady Borders Up to 3,000 or 4,000 feet.

Propagated by bulbs, tubers, or division, and in some cases also by seed.

[S. Sinhalese ; *T.*=Tamil].

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers etc.	Height, &c.
Achimenes grandiflora. Mexico	*Gesneraceae*	Crimson	1 ft. } Very showy, for beds or pots
A.—magnifica. New Grenada. Numerous varieties	,,	Scarlet	2 ft. }
Alocasia. See Foliage Pot Plants			
Amaryllis, "Mrs Garfield." Hort.	*Amaryllideae*	White & scarlet	1-2 ft. Very handsome
Amaryllis reticulatum. Brazil	,,	Scarlet	10 in. L. with white or pale centre
Amorphophallus campanulatus. "Kidaran" *S.* India and Ceylon	*Aroideae*	Lurid-purple	2 ft. Fl'r large, very foetid
A.—Titanum. Sumatra	,,	Dark-purple	10 ft. Fl'r 5 ft. high and 3 ft. across
Arisæma speciosa. "Walkidaran" *S.* India and Ceylon	,,	Greenish-purple	2 ft.
Belamcanda (Pardanthus) chinensis. "China Leopard Lily"	*Irideae*	Orange, spotted-brown	1½ ft.
Caladium bicolor.	*Aroideae*	Leaves pink and green	1-1½ ft. Very showy
C.—Humboldtii. (=C. argyrea) Brazil	,,	Leaves variegated-white	8 to 12 in. Very effective
C.—"Madam d'Hambourg." Hort. Numerous other varieties	,,	Crimson leaves	12—15 in. Very showy
Callipsyche aurantiaca. S America	*Amaryllideae*	Orange	2 ft.
C.—eucrosioides. Mexico	,,	Scarlet	2½ ft.
Canna, Orchid-flowered:—			
Variety "Austria"	*Scitamineae*	Lemon-yellow	3 ft. Leaves green.
,, "Australia"	,,	Bright red	,, ,,
,, "Britannia"	,,	Orange-yellow	,, ,,
,, "Kronos"	,,	Yellow & orange	,, ,,
,, "H. Wendland"	,,	Sca let & yellow	,, ,,
,, "Africa"	,,	Orange-red	2½ ft. Leaves bronze
,, "Pluto"	,,	Deep-red	,, ,,
,, "Rhea"	,,	Red	,, ,,

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Flowers, etc.	Height, etc.
C.—Gladiolus-flowered:—			
Variety "Circe"	*Scitamineae*	Salmon-pink	3 ft. Leaves green.
,, "Ehemanni"	,,	Crimson	,, ,,
,, "George King"	,,	Cerise	,, ,,
,, "Janus"	,,	Yellow	,, ,,
,, "M'dme Crozy"	,,	Scarlet, edged with yellow	,, ,,
Chirita Moorii. Ceylon	*Gesneraceae*	Mauve-violet	2 ft. Very showy
Crinum asiaticum. "Tolabo" S. Trop. Asia	*Amaryllideae*	White	2 ft. Flowers scented.
C.—augustum. Mauritius	,,	Pink & White	1 ft.
C.—defixum. India	,,	White	2 ft.
C.—erubescens. Trop. America.	,,	White & purple	2 ft.
C.—Moorei. S. Africa.	,,	Rose	1½ ft.
C.—Powelli. Hort	,,	Reddish	3—4 ft.
C.—speciosissimum.	,,	Pure white	2 ft.
C.—zeylanicum. Ceylon	,,	White	2 ft.
Dracontium gigas. Nicaragua	*Aroideae*	Brownish-red	8—10 ft.
Drimiopsis Kirkii. Zanzibar	*Liliaceae*	Whitish	10 in. Leaves spotted brown.
Eucharis grandiflora. Eucharis Lily. Colombia	*Amaryllideae*	Pure white	1½ ft.
Eucharis Sanderi. Colombia	,,	White	1 ft.
Eurycles amboinensis. Malaya, etc.	,,	,,	1—1½ ft.
E.—Cunninghamii. Australia	,,	,,	1 ft.
Gesnera cardinalis. Brazil	*Gesneraceae*	Scarlet	1½ ft.
G.—Hookeri. Colombia	,,	,,	1½—2 ft.
G.—magnifica. Brazil	,,	Purple	1—1½ ft.
Gloriosa Rothschildiana.	*Liliaceae*	Crimson	5—7 ft.
G.—superba. "Niyangala" S. Trop. Asia	,,	Orange-yellow	4—6 ft. Herbaceous climber
Gloxinia maculata. S America	*Gesneraceae*	Bluish-purple	1 ft. Fl's large, bell-shaped
Godwinia, See *Dracontium*			
Griffinia hyacinthina.	*Amaryllideae*	Blue	1 ft. Very showy
Haemanthus Lindeni. Congo	,,	Rosy-scarlet	1½ ft.
H.—multiflorus. Numerous other species. Trop. Africa	,,	Scarlet	1 ft.
Hippeastrum (Amaryllis) equestre.	,,	Bright red	1½ ft. Fl's large
H.—solandriflora. Numerous garden var's	,,	Pure white	1½ ft. Fl's in 2s or 3s
Hymenocallis amoena. Trop. America	,,	,,	1 ft. Fl's delicate
H.—ovata. W. Indies	,,	White	1 ft. ,,
H.—tenuiflora. S. America And many others	,,	,,	1 ft. ,,
Isoloma (Tydaea) amabilis. New Grenada	*Gesneraceae*	Dark-rose	1—2 ft.
Kæmpferia Roscoeana. Ceylon, India, etc.	*Scitamineae*	Bright-pink	1 ft. Showy

A BANK OF "ROSE AMARYLLIS."
(*Zephyranthes carinata*), in Peradeniya Gardens.
Flowers bright pink, very showy.

Name and Native Country. [Hort =Of garden origin].	Natural Order.	Colour of Flowers, etc.	Height, etc.
K.—rotunda. Ceylon, India and Malaya	*Scitamineae*	Red & white	1 ft.
K.—speciosa. S. Africa	,,	Violet-purple	1 ft.
Lowia grandiflora. Malaya	,,	White	2 ft.
L.—longiflora. Perak	,,	White & purple	2 ft.
Pancratium (Hymenocallis) caribaeum. W. Indies	*Amaryllideae*	White	2 ft. } Fl's delicate
P.—zeylanicum. "Wal-lunu" S. Ceylon	,,	,,	1 ft. } Fl's delicate
Polianthes tuberosa. Tuberose. Mexico	,,	,,	2—3 ft. Fl's very fragrant
Sinningia (Gloxinia) speciosa. "Wild Gloxinia." Brazil	*Gesneraceae*	Bluish-purple	1 ft. Showy
Sprekelia formosissima. Guatemala.	*Amaryllideae*	Bright crimson	1 ft.
Tacca cristata. Trop. Asia and Africa	*Taccaceae*	Brownish-purple	1½—2 ft.
Tulbaghia violacea. S. Africa	*Liliaceae*	Purplish-violet	1 ft.
Tydæa. See *Isoloma*			
Zephyranthes aurea. Peru	*Amaryllideae*	Bright-yellow	10 in.
Z.—carinata. "Rose Amaryllis."	,,	Bright-pink	10 in. Large fl's, very showy.
Z.—tubispatha. West Indies	,,	White	8—10 in.

S.=Sinhalese

ORNAMENTAL WATER PLANTS

Suited for the Low-Country.

Those in brackets, though not aquatics, are adapted for growing in water; if in tubs or pots partly submerged.

[C.=cuttings; S.=seed; Tu.=tubers; Div.=division.

Botanical and Common Name.	Natural Order.	How Propagated.	Descriptive notes.
Acorus Calamus. "Sweet Flag." "Wadakaha" S.	*Aroideae*	Div.	L. 3—4 ft. high, erect.
Aponogeton monostachyum. "Koddi" *T.*	*Naiadeae*	..	L. floating; fl's pale blue or white.
Azolla pinnata.	*Rhizocarpeae*	..	Small floating plants with pinnate leaves, forming a pretty sheet of light green.
(Carludovica palmata.)	*Cyclanthaceae*	Div. or S	Large, palm-like leaves, 6—8 ft. high.
Ceratopteris thalictroides. Water Fern	*Filiceae*	Div. or spores	Fronds pinnate, edible when tender, 1½—2 ft.
(Chrysalidocarpus lutescens.)	*Palmeae*	S or div.	Handsome, bushy feathery palm.
(Cyclanthus cristata.)	*Cyclanthaceae*	Div.	Stemless plant, large leaves, 6—8 ft. long.
(Cyperus alternifolius.) "Umbrella grass."	*Cyperaceae*	..	Leaves diverging in whorls, 2—3 ft.
(C.—Papyrus.) Papyrus	..	..	Large handsome brush-like leaves, 8–10 ft. high.
Eichhornia (Pontederia) Crassipes. "Water-hyacinth." S. America	*Pontederiaceae*	..	Floating plants, 1 ft. high; beautiful blue or lilac flowers.
Euryale ferox.	*Nymphaeaceae*	S	Large floating leaves with upright spines.
Hedychium coronarium.	*Scitamineae*	Div.	Fl's white, scented.
H.—gardnerianum.	..	..	Fl's yellow.
Lasia spinosa. "Kohilla" S.	*Aroideae*	Div. or S	Leaves spinous, pinnatifid.
Limnanthemum indicum. "Water Snow-flake."	*Gentianaceae*	..	Floating heart-shaped leaves. Fl's white.
Limnocharis Humboldtii. "Water Poppy."	*Alismaceae*	..	L. oval, floating. Fl's bright yellow.
L.—Plumierii.	..	Div.	L. erect, pale green. Fl's smaller, yellow.
(Ludovia crenifolia)	*Cyclanthaceae*	..	Palm-like leaves, 3—4 ft. long.
Marsilea quadrifolia.	*Rhizocarpeae*	..	Small clover-like plant, allied to the Ferns.
Monocharia hastæfolia. "Diya-habarala" S.	*Pontederiaceae*	..	Fl's brilliant purplish blue.
Myriophyllum proserpinacoides.	*Halorageae*	..	Floating feathery leaves.
Nelumbium speciosum. Lotus Lily; "Nelun" S.	*Nymphaeaceae*	S or Tu.	Large round peltate leaves; fl's rose-coloured or white, scented.

S.=Sinhalese; *T.*=Tamil].

Botanical and Common Name.	Natural Order.	How Propagated.	Descriptive notes.
Nipa fruticans. "Nipa," or Water Palm. Ceylon & Malaya	*Palmae*	S	Feathery-leaved palm, 8—10 ft. high, found in lagoons near the sea.
Nymphæa Lotus. Water Lily, "Olu" *S.*	*Nymphaeaceae*	Tu. or S	Large floating leaves. Fl's pale pink to bright rose.
N.—stellata. "Manel" *S.*	,,	,,	Fl's whitish-violet to light-blue.
Ouvirandra fenestralis. Lattice-leaf plant. Madagascar.	*Naiadaceae*	Tubers	Curious lace-like floating leaves.
Oxystelma esculentum. "Kulap-palai" *T.*	*Asclepiadeae*	S or C	Beautiful twiner with cream and pink fl's.
Pistia Stratiotes. Water Lettuce	*Aroideae*	Div.	Floating stemless plant.
Pontederia crassipes. "Water Hyacinth." See *Eichhornia*	*Pontederiaceae*	,,	Floating plants, 1 ft. high; beautiful blue or lilac fl's.
(Rhapis flabelliformis).	*Palmae*	,,	Cane-palm. 5—6 ft. high.
Sagittaria sagittifolia. "Arrow-head."	*Alismaceae*	,,	Large sagittate leaves.
(Schizocasia [= Alocasia] Portei).	*Aroideae*	,,	Very large, hastate, reddish eaves, with prickly leaf stalks.
Susum anthelminticum. "Induru," *S.*	*Flagellariaceae*	S or div.	Long floating shoots, with large erect, handsome panicles.
Typha angustifolia. Bull-rush	*Typhaceae*	Div.	Erect ribbon-like leaves, 4—6 ft. high.
Victoria regia. Giant Water-lily See illustration	*Nymphœaceae*	S	L. floating, circular, 6—8 ft. in. diam. with a raised margin; fl's large, cream or pink, strongly scented. A remarkable plant.

SELECTED SUCCULENT OR CACTUS PLANTS

This class of plants is not generally suited to a humid climate, the great majority of them being indigenous to dry regions, as Mexico and South Africa. Those marked ‡ flourish in a wet climate and up to 5,000 ft. elevation.

[Su.=suckers; C.=cuttings; S.=seeds; Tu =tubers].

Name and Native Country [Hort.=Of garden origin].	Natural Order	How Propagated.	Descriptive notes.
‡**Agave americana variegata.** Hort	*Amaryllideae*	Su. or S	Stemless plants with large succulent pointed leaves, the latter often spiny at the margin.
A.—densiflora. Mexico	,,	,,	
A.—heteracantha. Texas, &c.	,,	,,	
‡**A.—Morrisii.** Jamaica	,,	,,	L. rather spathulate.

S.=Sinhalese ; *T.*=Tamil

GIANT WATER LILY (*Victoria regia*), IN PERADENIYA GARDENS.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Descriptive notes.
A.—rigida. Sisalana, S. America. Numerous other species	*Amaryllideae*	Su. or bulbils	*Sisal Hemp*, which see.
‡Aloe saponaria. S. Africa. Numerous other species	*Liliaceae*	,,	Small plants, usually with a short stem, bearing a rosette of succulent, spotted grey leaves.
‡Bromelia Pinguin. W. Indies	*Bromeliaceae*	Offsets	6—8 ft. Stemless plants, with long spiny leaves.
‡Caralluma campanulata. Ceylon and India	*Asclepiadeae*	C	Dwarf leafless plant, with square stems.
‡Cereus grandiflorus. "Night-flowering Cactus," W. Indies	*Cactaceae*	C	Creeper, reaching the tops of tall trees. Fl's large, white.
C.—jamacaru. Brazil	,,	Offsets or C.	Stout single stem, unbranched, 4—5 angled.
‡C.—peruvianus. "Torch Thistle," S. America	,,	C	20—30 ft. Large, branching, tree-like plant.
‡C.—serpentinus. Mexico	,,	C	Creeper, with thin hairy stems.
Dyckia altissima. Brazil	*Bromeliaceae*	Offsets	1 ft. Leaves narrow, wiry and recurving.
Echinocactus, numerous species. Mexico	*Cactaceae*	,,	Small unbranching, ovoid or globose, succulent plants.
Echinopsis (Cereus) multiplex. Brazil	,,	,,	Erect unbranching plant with numerous spine-covered angles.
‡Epiphyllum truncatum. Brazil	,,	C	Small shrub, with handsome rose-coloured fl's.
Furcræa gigantea. Trop. America	*Amaryllideae*	Su. or bulbils.	8—10 ft. See *Mauritius Hemp*.
Gasteria trigona. Salm-Dyck Aloe. S. Africa	*Liliaceae*	Offsets.	½ ft. Leaves very thick, distichously arranged. Suitable for pots.
G.—verrucosa. S. Africa	,,	,,	
Haworthia attenuata. S. Africa. Numerous other species.	,,	,,	Small Aloe-like plants, leaves in a rosette.
‡Kalanchoe laciniata. Trop. Africa	*Crassulaceae*	C	1 ft. "Life-plant." L. deeply cut.
‡Lomatophyllum borbonicum. Bourbon	*Liliaceae*	S	3 ft. Bears long spiny fleshy leaves on a short stem.
Mammillaria glauca. Mexico	*Cactaceae*	Offsets	Dwarf plants, composed of close tubercles, each of which is terminated by a bunch of hairy spines.
M.—megacantha. Mexico	,,	,,	
M.—nobilis. Mexico. Numerous other species.	,,	,,	
Nopalea coccinellifera. Mexico	,,	C	4—5 ft. A branching leaf-less shrub, flat oval spiny tubercles.
Opuntia Dillenii. S. America. Prickly Pear	,,	C	4—5 ft. Branching leafless shrubs, with large circular or oval tubercles, clothed with tufts of hair like spines.
O.—grandis. Mexico	,,	C	
O. robusta. Mexico	,,	C	

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Descriptive notes.
‡Pedilanthus tithymaloides. S. America	*Euphorbiaceae*	C	3—4 ft Erect shrub.
‡Phyllocactus amabilis. Hort.	*Cactaceae*	C	Small shrubs, with flattened leaf-like branches; flowers showy, bright pink, etc.
‡P.—crenatus. Honduras	,,	C	
P.—grandis.	,,	C	
‡P.—speciosissima. Hort. Numerous other species and hybrids.	,,	C	
‡Rhipsalis Cassytha. Trop. Asia	,,	C or S	Epiphytic leafless plant, cylindrical pendulous stems. The only Asiatic cactus.
R.—pachyptera. Trop. America	,,	C	Large flattened leaf-like branches.
Stapelia grandiflora. S. Africa	*Asclepiadeae*	C	Small leafless plant.
Vitis quadrangularis. Trop. Asia, etc.	*Ampelideae*	C & Tu.	Climber, with square succulent stems.

PINNATE OR FEATHER-LEAVED PALMS.

Those marked † are best suited to elevations above 3,000 feet.

Acanthophoenix crinita. Mauritius and Bourbon
Acanthoriza aculeata. Cent. America
Acrocomia sclerocarpa. "Macaw Palm." Trop. America
Actinorrhytis calapparia. Malaya
Archontophoenix Alexandrae. Queensland
A.—Cunninghamii. (=*Seaforthia elegans*) Queensland
Areca Catechu. "Arecanut." Trop. Asia
A.—concinna. Ceylon
A.—triandra. Assam & Burma
Arenga obtusifolia. Java & Sumatra
A.—saccharifera. "Gomuti," or "Sugar Palm." Malaya
A.—Wightii. Malabar
Astrocaryum rostratum. Brazil
Attalea Cohune. "Cohune Palm," Honduras
A.—excelsa. Brazil
Bactris major. Colombia
Bentinckia Condapana. Travancore
Calamus ciliaris. Malaya. Numerous other species; Ceylon, India, etc.
Calyptrocalyx spicatus. Moluccas
Caryota Cumingii. Philippines
C.—ochlandra. China
C.—rumphiana. Malaya & Australia
C.—urens. Trop. Asia
Catoblastus præmorsus. Venezuela
†Ceroxylon andicola. Colombia
Chamœdorea elegans. Mexico
C.—Sartorii. ,,
C.—Tepijilote. Mexico
Chrysalidocarpus lutescens. Madagascar
Cocos flexuosa. Brazil
C.—insignis. ,,
C.—nucifera. Coconut Palm. Hab. ?
C.—plumosa. Brazil
C.—schizophylla. Brazil
C.—weddelliana. ,,
C.—romanzoviana ,,
Cyrtostachys Renda. "Sealing-wax Palm." Sumatra
Desmoncus major. Trinidad
Dictyosperma album. Mauritius
D.—fibrosum. Madagascar
Didymosperma distichum. Sikkim
D.—porphyrocarpum. Java
D.—tremulum. Siam
Diplothemium maritimum. Brazil
Drymophlœus appendiculatus. Malaya
D.—ceramensis. Moluccas
Dypsis madagascariensis. Madagascar
Elæis guineensis. "Oil Palm." Trop. Africa
Euterpe edulis. Trop. America
E.—oleracea. Brazil
Exhorrhiza Wendlandiana.
Geonoma gracilis. Costa Rica

DIDYMOSPERMA DISTICHUM.

A curious fan-shaped palm from Sikkim.

G.—princeps. Colombia
G.—schottiana. Brazil
Hedyscepe canterburyana. Lord Howe's Island
Heterospathe elata. Amboyna
Howea belmoreana. Lord Howe's Island
H.—forsteriana. „ „
Hydriastele wendlandiana. Queensland
Hyophorbe amaricaulis. Mauritius
Hyophorbe Verschaffeltii. Rodriguez
Jubæa spectabilis. "Coquito Palm." Chili
Kentia australis. Lord Howe's Island
K.—elegantissima. **Hab?**
K.—Sanderiana.
Korthalsia Junghuhnii. Java
Loxococcus rupicola. "Dotalu." Ceylon
Manicaria saccifera. Cent. America
Martinezia caryotaefolia. Colombia

AVENUE OF ROYAL PALM (*Oreodoxa regia*), PERADENIYA GARDENS, CEYLON.

DOUBLE COCONUT, OR COCO DE MER.
Lodoicea Sechellarum. (Male Tree).

M.—lindeniana.
Maximiliana regia. "Cocurita Palm," Brazil and Guiana
Metroxylon Rumphii. Prickly Sago-Palm Moluccas, New Guinea
M.—Sagu. Sago Palm. Java, Sumatra
Myrialepis Scortechnii. Malaya
Nephrosperma van-Houtteanum. Seychelles
Nipa fruticans. "Nipa" or "Water Palm." Malaya, Ceylon, etc.
Oncosperma fasciculatum. "Katu-Kitul" *S.* Ceylon
O.—filamentosa. "Nibung Palm," Java
Orania regalis. Philippines. (Pericarpedible).
Orbignya Sagottii. Demerara
Oreodoxa oleracea. W. Indies
O.—regia. Cuba and Panama
Phœnix dactylifera. Date Palm. Africa
P.—paludosa. India and Cochin China
P.—reclinata. S. E. Africa
P.—Rœbelinii. A handsome species
P.—rupicola. Sikkim
P.—sylvestris. Wild Date-palm; India
P.—zeylanica. Ceylon
Pholidocarpus Ihur. Malaya
Phytelephas macrocarpa. "Ivory-nut Palm." Colombia
Pinanga Kuhlii.
P.—paradoxa. Malaya
P.—spectabilis. Malaya
Plectocomia elongata. Sumatra, etc.
Prestœa trinitensis. Trinidad
Ptychandra glauca. Malaya
Ptychococcus paradoxa. New Guinea

S = Sinhalese

PHOENIX RUPICOLA. A graceful feathery palm.

AVENUE OF PALMYRAH PALM (*Borassus flabilefer*),
IN PERADENIYA GARDENS.

Ptychoraphis augusta. Nicobar Islands
P.—singaporensis. Malaya
Ptychosperma Macarthurii. Trop. Australia
P—perbreve. Fiji
Raphia Hookerii. Trop. Africa
R.—Ruffia. Madagascar
Rhopaloblaste hexandra. Moluccas
Roscheria melanochætes. Seychelles
Scheela excelsa. Brazil
Synechanthus fibrosus. Guatemala
Veitchia Johannis Fiji
Wallichia caryotoides. Burma, etc.
W.—densiflora. Himalaya
Zalacca edulis. Malaya

FAN-LEAVED PALMS.

Bismarckia nobilis. Madagascar.
Borassus flabellifer. Palmyra Palm. India & Africa
Brahea nitida. Mexico
†Chamærops humilis. S. Europe & N. Africa
Copernicia cerifera. Carnauba Wax-palm. Brazil
Corypha umbraculifera. Talipot Palm. Ceylon & S. India
†Erythea armata. California.
Hyphæne thebaica. Doum Palm. (One of the few branching palms) Trop. Africa
Latania Commersonii Mauritius and Bourbon
Licuala elegans. Sumatra
L.—gracilis. Java
L.—grandis. Pacific Islands
Licuala peltata. Assam, Burma, etc.
L.—spinosa. Malaya
Linospadix Micholitzii. Malaya
Livistona altissima. Java
L.—australis. Australia
L.—chinensis. China and Japan
L.—Hoogendorpii. Java
L.—humilis. Australia
L.—Jenkinsiana Assam
L.—olivæformis. Java
L.—rotundifolia.
L.—subglobosa.
Lodoicea sechellarum. "Double Coco-nut," or "Coco-de-mer." Seychelles.
Phœnicophorium sechellarum. (=*Stevensonia grandiflora*). Seychelles
Pritchardia aurea. Fiji
P.—Martii. Sandwich Islands
Pritchardia pacifica. Fiji
†Rhapis flabelliformis. China and Japan
†R.—humilis. China
Sabal Adansonii. "Dwarf Palmetto." S. United States
S.—Blackburniana. Bermuda
S.—filamentosum. Jamaica.
S.—glaucescens. Trinidad
S.—palmetto. Palmetto Palm. S. United States
†Serenoa serrulata. "Saw Palmetto." S. United States
Stevensonia grandiflora. Seychelles
Teysmannia altifrons. Sumatra, Perak, etc.
Thrinax argentea. West Indies
T.—barbadensis. Barbados
T.—excelsa. Jamaica
T.—parviflora. W. Indies
†Trachycarpus (Chamærops) Fortunei. China
Verschaffeltia splendida. Seychelles

CEYLON INDIGENOUS PALMS.

Those marked * are endemic, i.e., confined to Ceylon.

Botanical and Vernacular Names.	Natural locality.	Descriptive notes.
Areca Catechu. Betel-nut; "Puwak" *S.* "Kamukai" *T.*	Moist low-country	Stems straight, slender, 30—50 ft. high.
*A.—concinna. "Lena-teri" *S.*	"	Stems straight, slender, 8—12 ft. L pinnate.
Borassus flabellifer. Palmyra; "Tal" *S.* "Panai" *T.*	Dry region	Fan-leaved palm, 60—70 ft. high.

S.=Sinhalese. *T.*=Tamil.

TALIPOT PALM. *Corypha umbraculifera.*

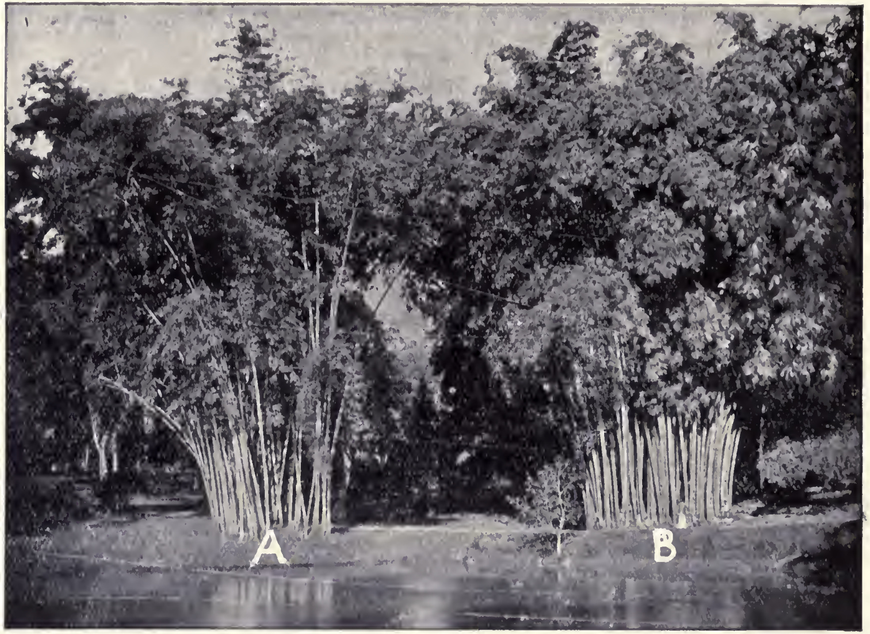
Botanical and Vernacular Names.	Natural locality.	Descriptive notes.
*Calamus delicatalus. "Narawel" *S.*	Moist low-country up to 1,000 ft.	Climbing palms, with spiny, elegant, pinnate leaves. The slender stems are the "Canes of commerce.
*C.—digitatus. "Kukula-wel" *S.*		
*C.—ovoideus. "Thambutu-wel" *S.*		
*C.—pseudo tenuis.		
*C.—pachystemonous.		
*C.—radiatus. "Kukula-wel" *S.*		
*C.—rivalis. "Ela-wel" *S.*		
C.—Rotang. "Wè-wel" *S.* "Perampu" *T.*	Dry region	
*C.—Thwaitesii.	Moist low-country up to 1,000 ft.	
*C.—zeylanicus.		

S= Sinhalese ; *T*=Tamil

AVENUE OF TALIPOT PALMS (*Corypha umbraculifera*), IN PERADENIYA GARDENS.

Botanical and Vernacular Names.	Natural locality.	Descriptive notes.
Caryota urens. Toddy Palm; "Kitul" *S.*	Moist low-country up to 3,000 ft.	Trunk 40 to 60 ft L, bipinnate, very handsome.
Cocos nucifera. Coconut; "Pol" *S.* "Tennai" *T.*	Low-country up to 2,000 ft., cultivated	Pinnated-leaved; trunk 50—80 ft., never straight
Corypha umbraculifera. Talipot; "Tal" *S.*	Moist region, below 2,000 ft.	Trunk stout, erect, 40—80 ft. L. immense, 10—20 ft. diam. Seeds large, ivory-like, made into buttons, etc.

S.=Sinhalese; *T.*=Tamil



A. BUILDING BAMBOO OF JAVA. (*Gigantochloa aspera*).
B. GIANT BAMBOO. (*Dendrocalamus gigantea*

IN PERADENIYA GARDENS

Botanical and Vernacular Names.	Natural locality.	Descriptive Notes.
*Loxococcus rupicola. "Dotalu" *S.*	Moist region, 1,000 to 5,000 ft.	Stems slender, erect, 20-30 ft. L. pinnate.
Nipa fruticans. Nipa, or Water-Coconut; "Gin-pol" *S.*	South-west Coast	Rootstock 1½ ft. diam. L. pinnate, 10-15 ft. long.
Oncosperma fasciculatum. "Katu-kitul" *S.*	Moist region up to 1,500 ft.	Stems clustered, 40—60 ft. L. pinnate, leaflets long, pendulous,
Phœnix pusilla. "Inchu" *T.*	Forests of dry region	Stem very short. L. 4-5 ft. long, lower leaflets reduced to spines.
P.—zeylanica. "Indi" *S.*	Moist low-country	Stem 6—20 ft. L. pinnate, with numerous long narrow leaflets.

BAMBOOS, ORNAMENTAL GRASSES AND SEDGES.

Those marked † are suited for Up-country.

ORNAMENTAL GRASSES AND SEDGES:—

Anthistiria gigantea. Malaya.—A handsome grass, 5-7 ft. high, with large graceful drooping flowering panicles.

†**Arundo Donax variegata.** Mediterranean, Egypt, etc.— A bushy variegated grass, 6-10 feet high, excellent for ornamental effect.

Carex brunnea variegata. India, 1 ft. high, suitable for growing in pots.

Coix Lacryma. Jobs' Tears; "Kirindi-mana" *S.* Ceylon, India & Malaya.—A bushy annual, 3-4 ft. high, with hard bead-like fruit. See *Ornamental seeds.*

† **Cyperus alternifolius.** "Umbrella-plant." Australia.—An ornamental grass-like sedge, with narrow diverging leaves, about 3 ft. high.

C—Papyrus. Egyptian Papyrus. Egypt.—A large, very ornamental plant with brush-like leaves, suitable for swamps or water margins.

† **Euchlaena (Reana) luxurians.** "Teosinte." Guatemala.—An annual grass, 10-15 ft. high, very handsome when in flower. See *Fodder Grasses.*

† **Isolepis gracilis.** Sub-tropics.—A favourite pot-plant for green-house and conservatory decoration, with pendulous hair-like leaves.

Oplismenus Burmanii variegatus. New Caledonia.—A very ornamental creeping grass, the leaves being white with a central green or pink stripe.

† **Panicum plicatum.** Ceylon, India, etc.— A handsome grass, with large broad leaves, 2-3 ft. high.

† **P.—pulchrum.**—An ornamental species, 1½ ft. high.

Pennisetum longistylus. Abyssinia.—A handsome grass, 4-5 ft. high.

† **Phalaris arundincea.** "Ribbon grass," or "Gardener's garter." S. Europe.—A small variegated grass, suitable for edgings, etc.

Tricholaena rosea. Natal Red-top Grass. Natal.—A handsome grass when bearing its masses of purplish-crimson flowers, 1-2 ft. high.

S.=Sinhalese; *T*=.Tamil

GIANT BAMBOO (*Dendrocalamus giganteas*), IN PERADENIYA GARDENS.

BAMBOOS AND BAMBOO-LIKE GRASSES, ETC:—

Arundinaria suberecta. A small elegant bamboo, with delicate drooping foliage, 12—16 in. high; a favourite pot-plant.

† **Bambusa aurea.** Japan.—Stems yellow; light open foliage, very ornamental.

† **B.—Madake.** Japan.—10-15 ft. high, branches erect.

SIAMESE BAMBOO. *Bambusa siamensis*

† **B.—nigra.** India.—An interesting species, 25-30 ft. high, with the lower part of the stems purplish black.

B.—Siamensis. Burma, Siam.—20 ft. high, leaves small, in dense graceful plumes. An exceedingly graceful bamboo.

B.—vulgaris. "Una" *S.* Common yellow-, or golden-bamboo. Ceylon, Tropics generally.—A very handsome species, 30-40 ft. high, with pale yellow stems, 3-4 in. in diam. Most useful for making pots, scaffolding, etc. Thrives best on river banks, up to 5,000 ft. in valleys.

S.=Sinhalese

Dendrocalamus giganteus. Giant Bamboo. Burma, Malaya.—A magnificent species attaining a height of over 100 ft. and 40-50 ft. in diameter of clump; stems 10 in. or more in diameter. Used for buildings, plant-pots, etc.

† **Hamiltonii.** Tropical Himalaya.—A large species, suited to medium elevations

D —strictus. "Male"-, or "Solid-Bamboo. India, Java, etc.—A large handsome spreading species, 30 ft. high. Stems about 2 inches or more in diam., sometimes almost solid; used for shafts, lance staves, fence posts, &c.

Gigantochloa aspera. Building Bamboo. Java.—A graceful species, resembling the Giant Bamboo, 70-80 ft. high, with stout strong stems.

Gynerium saccharoides. Trop. America.—A tall handsome grass, 15-20 ft high, with long ribbon-like leaves.

GIANT BAMBOO, CLOSE VIEW.

Ochlandra maculata. "Mottled Bamboo;" "Ranabata-li" *S.* 12 to 15 ft. high, leaves broad, up to 10 in. by 2½ in., stems blotched with brown.

O.—Rheedii. Quill Bamboo." 12-15 ft. high. Leaves broad and long.

O.—Travancorica. S. India. 15-20 ft. high. Large handsome broad leaves.

† **Oxytenanthera Thwaitesii.** Ceylon and S. India. A large reed, 10-12 ft. high. with leaves 12 in. long by 1-1½ in. broad; 4,000 to 6,000 ft. elevation.

Thyrsanolæna acarifera. Tropical Asia.—A large bushy spreading reed, 8-10 ft. high, with large broad leaves.

S.=Sinhalese

CHAPTER XVII.

POT PLANTS: SELECTIONS SUITABLE FOR LOW AND MEDIUM ELEVATIONS

ORCHIDS :—

The cultivation of orchids affords one of the most interesting and pleasant occupations in the tropics, as elsewhere, and not a few enthusiasts in Ceylon, India, etc., expend a good deal of money on importing and growing showy kinds. Orchids may be divided into two types, (1) *terrestrial* or ground-orchids, and (2) *epiphytes*, —that is plants which are found growing naturally upon trees or rocks. In order to grow orchids successfully, it is essential to know to which of these types they belong, also the elevation and conditions of climate under which they grow in their natural state. Orchids of a dry region generally fail when removed to a wet climate, and *vice versa* ; thus Cattleyas and other South American species, which are accustomed to a long dry period, soon deteriorate in the moist climate of the south-west part of Ceylon, especially if not protected during the long rainy season. Nevertheless, it is well to remember that in cultivation, orchids, like other plants, are often adaptable to altered conditions, and careful observation of the progress of the plants will generally suggest the more beneficial modifications to adopt in their treatment. Epiphytic orchids generally thrive better on trees than in pots, but the former conditions cannot always be provided, and for various reasons pot-culture is usually the more suited to the amateur grower. Many species thrive best when fully exposed to the sun, provided sufficient moisture is available at the roots ; others, however, grow and flower most freely under light shade.

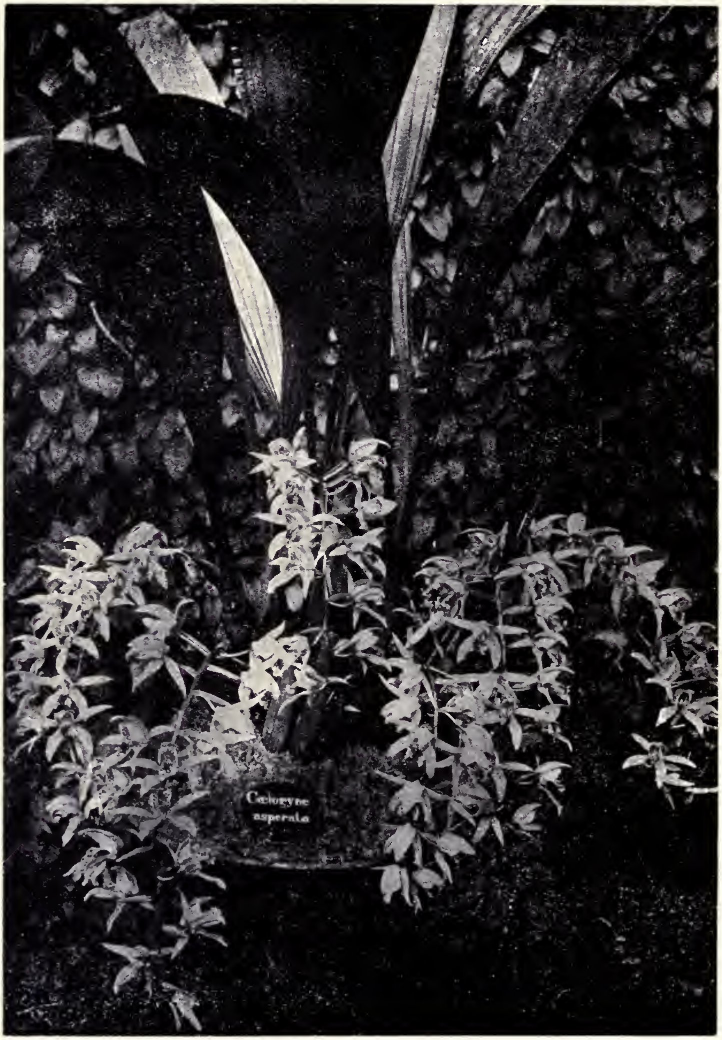
Potting orchids.—Special kinds of pots with several drainage holes and perforated sides are made for growing orchids in. When these are not procurable, very useful substitutes may be found in well-seasoned joints of large bamboos, these being cut so as to leave one of the divisions, the joint being then perforated at the bottom

and sides. Another useful style of bamboo pot for orchids is afforded by a longitudinal section of the joint, with the corners rounded off; thin copper wire should be strung through the margins to hold the plant and potting material in position, a layer of coir fibre or beaten coconut husk being placed between the material and the wires. For epiphytes, a potting mixture consisting of old bark,

GIANT ORCHID. *Grammatophyllum speciosum.*

broken crocks or pieces of porous brick and some sphagnum moss is essential. Peat is usually an excellent ingredient in mixtures for orchids, but is not procurable in Ceylon. Sphagnum moss is difficult to obtain, being only found in a limited area on Horton Plains in Ceylon. Bracken roots are a useful component in orchid mixtures, and being common up-country, is easily obtained. Coir fibre, which should be well-leached, is a most serviceable material

much employed at Peradeniya for growing epiphytic orchids, and is indispensable for fixing them on boards, stems of trees, etc.; it is



CŒLOGYNE ASPERATA.
FLOWERS CREAMY-YELLOW GROUND, VERY FRAGRANT.

also used in composts for terrestrial orchids, the other ingredients being those mentioned above in addition to well-decomposed cow manure.

VIEW IN THE ORCHID HOUSE, PERADENIYA GARDENS.

The following are among the most showy and successfully grown orchids at Peradeniya, Ceylon, (elevation 1,540 ft., rainfall about 80 inches):—

[Ep.=epiphyte; Terr.=terrestrial.]

Name and Native Country.		Class.	Descriptive Notes.
Aerides odoratum.	India and China	Ep.	Fl's scented, white, blotched with magenta.
Angræcum sesquipedale.	Madagascar	,,	Fl's very large, ivory-white, long spur.
Cattleya Eldorado.	Rio-negro	,,	Fl's bluish-whi.e and magenta.
C.—Gaskelliana.	Venezuela	,,	Fl's scented, white and amethyst-purple.
C.—Gigas.	Colombia	,,	Fl's very large, rose, crimson-purple and yellow.
C.—labiata.	Brazil	,,	
C.—Mossiae.	Venezuela	,,	Fl's large, crimson and rose.
Cattleya Skinneri.	Guatemala	,,	Fl's rose-purple.
C.—Trianæ	Colombia	,,	Fl's purple-crimson, very showy.
Chysis bractescens.	Peru	,,	Fl's large, creamy-white; stout fleshy stems.
Cœlogyne asperata	Borneo	Terr.	Fl's in long drooping racemes, creamy yellow, scented.
C.—Dayana.	Borneo	,,	Psuedo-bulbs 3-8 in. L. 2-3 ft., fl's creamy yellow.

Name and Native Country.	Class.	Descriptive Notes.
Cymbidium Lowianum. Burma	Ep.	Fl's large, yellowish green, with a crimson blotch.
Dendrobium Dalhousianum. Burma	,,	Stems 3-5 ft. long; fl's large, tawny-yellow and rose.
D.—densiflorum. India	,,	Fl's pendulous, amber-yellow and orange.
D.—Farmeri. India and Burma	,,	Yellow, tinted with pink.
D.—fimbriatum. Burma	,,	Fl's pendulous, rich orange-yellow.
D.—Macarthiae. "Wesak-mal" Cey.	,,	Stems slender, 2-2½ ft.; fl's rose-pink.
D.—nobile. India and Burma	,,	Fl's large and showy, white tipped with rose-purple.
D.—thyrsiflorum. Burma	,,	Stems 18-30 in. high; fl's in large drooping clusters, white and yellow.
D.—Wardianum. Assam	,,	Stems 1 to 2 ft.; fl's white, purple and yellow.
Epidendrum radicans. Mexico	,,	Stems long, slender, scandent; fl's terminal, bright orange-scarlet.
Grammatophyllum speciosum. Malaya	,,	Stems 6 to 10 ft. long; fl's ochre-yellow, blotched with purple.
Laelia purpurata. Brazil	,,	Fl's large and showy, rose-white and crimson-purple.
Oncidium luridum. West Indies	,,	L. leathery, 1-2 ft. long; fl's yellow blotched with brown.
O.—papilio. "Butterfly orchid"		Fl's large, butterfly-shaped.
Peristeria elata. "Holy Ghost" Orchid. Panama	Terr	L. 2-3½ ft.; fl's scented, waxy white, globose; centre resemb'g a dove.
Phaius (Thunia) Bensoniæ. Moulmein	,,	2 ft. high; fl's large, amethyst-purple.
P.—Blumei. Java	,,	Fl's buff-yellow, mottled with red.
Phalænopsis amabilis. Malaya	Ep.	L. broadly oval, 6-15 in. long: fl's large, white, spotted with red.
P.—Schilleriana. Philippines	,,	L. 10-18 in. long, blotched with grey; fl's large, rose-purple.
Renanthera coccinea. Burma and Cochin China	,,	Stems 4-7 ft., creeping; fl's in large raceme, blood-red, spotted with yellow, very showy.
R.—Imschootiana. Burma	,,	Height 6-24 in. fl's bright vermilion.
Saccolabium guttatum. Fox-tail Orchid. India, Ceylon, etc.	,,	Fl's white, spotted with amethyst-purple; showy.
Stanhopea grandiflora. Eucador	,,	Fl's large, fragrant, yellow, shaded with orange and crimson.
S.—tigrina. Mexico	,,	Fl's large, scented, blood-red, spotted with yellow.
Vanda cœrulea. North India and Assam	,,	Stems 1-3 ft., fl's large, handsome, light blue.
V.—Hookeriana. Malaya	,,	Stem and leaves cylindrical; fl's purple magenta and orange-yellow.
V.—Roxburghii. Ceylon & Burma	,,	Fl's pale buff or grey.
V.—spathulata. Ceylon & South India	,,	Stems several ft. long; fl's large, bright yellow.
V.—teres. India, Burma, etc.	,,	Stems and leaves cylindrical, 2-7 ft. high; fl's rose-magenta and orange-yellow.
V.—tricolor. Java	,,	Fl's yellow, spotted brown. fragrant.

SELECTED CEYLON INDIGENOUS ORCHIDS

Arranged According to Regions Where Found

MONTANE ZONE (3,000 to 6,000 Ft.):—

[Terr.=terrestrial; Ep.=epiphyte; S.=Sinhalese].

Name.	Descriptive Remarks.

Arundina minor (Terr.). Fl's pale pink, lip yellow.
Bulbophyllum elegans (Ep.). Fl's dull purple tinged with green, lip orange.
Calanthe purpurea (Terr.). Fl's pale purplish-pink.
C.—**veratrifolia** (Terr.). Fl's pure white, lip pale-pink or dull-yellow.
Chrysoglossum maculatum (Ep.). Fl's pale green with reddish blotches, lip white.
Cirrhopetalum grandiflorum (Ep.). Fl's yellow, veined and spotted with red; lip purple; rare.
Cleisostoma tenerum (Ep.). Fl's yellow, lip white, with pink wings.
Cœlogyne odoratissima (Ep.). Fl's white, with a yellow stain on lip; scented.
Cymbidium ensifolium (Ep.). Fl's dull yellow, lined with pink; sweet-scented.
Dendrobium aureum (Ep.). "Primrose orchid." Fl's pale yellow, sweet-scented.
Eria bicolor (Ep.). "Lily of the Valley Orchid." Fl's pure white, on purple red stalks.
Ipsea (Pachystoma) speciosa (Terr.). Daffodil Orchid; "Nagamarapu-ala," *S.* Fl's bright yellow. Open patnas.
Phajus bicolor (Terr.). Open pastures; fl's purplish orange, or pale orange-yellow.
Saccolabium roseum (Ep.) Fl's pale-purple.

Moist Low-Country (1,000 to 3,000 Ft.):—

Acanthophippium bicolor (Terr.). Fl's bright yellow tipped with purplish red.
Aerides lineare (Saccolabium paniculatum) (Ep.). Fl's white, tinged with pale pink.
Cymbidium bicolor (Ep.). Fl's cream coloured, stained with reddish purple.
Dendrobium cruminatum "Sudupareiyamal." "Dove or Pigeon Orchid." (Ep.). Often on Coconut stems. Fl's pure white.
D.—**Macarthiae** "Wesak-mal." (Ep.). Fl's violet-pink, rarely white. Rare; moist forests below 2,000 ft.
D.—**macrostachyum** (Ep.). Fl's pale-green or yellow, tinged with pink. Up to 4,000 ft.
Eulophia macrostachya (Terr.). Fl's purplish green, lip yellow.
E.—**sanguinea** (Terr.). Fl's dull purplish-red, lip pinkish-green.
E.—**virens** (Terr.). See *Dry Region Orchids.*
Phajus luridus (Terr.). Fl's yellow, striped longitudinally with red, lip yellow. Endemic, rare.
Pholidota imbricata (Ep.). Fl's white, with a pinkish or yellowish tinge.
Saccolabium ochraceum (Ep.). Fl's yellow, with red transverse lines.
S.—**Wightianum** (Ep.). Fl's pale yellow, tinged with red.
Sarcochilus pulchellus (Ep.). Fl's pure white, lip tinged with orange.
Tainia bicornis (Terr.). Fl's pale olive-green, stained with purple.

(Intermediate Zone 2,000 to 3,500 Ft.):—

Aerides cylindricum. (Ep.). Fl's creamy white. Foliage like *Luisia.* (1,000 to 4,000 ft.).

VIEW IN FERNERY, PERADENIYA GARDENS.

Anæctochilus regalis (Terr.). "Wana-raja," *S.* Beautiful velvety brownish leaves, with coloured veins. Among leaves in moist shaded forests.

Cirrhopetalum grandiflorum (Ep.). See *Montane Zone Orchids.*

Cottonia macrostachya (Ep.). Fl's yellowish-green, veined with pink, resembling an insect. Rare.

Geodorum dilatatum (Terr.). Fl's white, lip suffused with yellow and pink.

Habenaria pterocarpa (Terr.). Fl's white, with the spur green. Endemic.

Zeuxine regia (Terr.). "Iru-raja," *S.* Handsome leaves, with longitudinal white veins. Moist forests.

Dry (or Intermediately-Dry) Region :—

Eulophia virens (Terr.). Fl's yellowish-green, lip white, with crimson lines.

Habenaria plantaginea (Terr.). "Pigeon Orchid." Fl's large, pure white.

Saccolabium guttatum (Ep.). "Fox-tail Orchid." Fl's in brush-like pendulous raceme ; white, dotted with violet-pink, very handsome.

Vanda Roxburghii (Ep.). Fl's pale buff or grey, streaked with brown lines. Scented.

V.—spathulata (Ep.). Fl's bright yellow, in long erect racemes. Showy.

FERNS

These comprise an extensive family of plants, and are especially popular on account of the beauty and gracefulness of their foliage. Mixed with other plants in the embellishment of verandahs and plant-houses, ferns are always effective, while in floral decorations their cut fronds are often indispensable. Contrary to general opinion, ferns, with few exceptions, are not difficult to cultivate ; they may easily be grown in pots, boxes, etc., provided the proper conditions of soil, moisture and temperature are afforded. By observing the conditions under which the plants grow and flourish in their natural state, an accurate idea may be formed of their requirements ; it will thus be seen that they are usually found luxuriating on humous fibrous soil and limestone rock, occupying shady banks or gullies, by the side of streams or water courses. Therefore, it may be accepted as a general rule that three essential conditions in their requirements are shade, moisture and perfect drainage at the root. Though ferns generally are regarded as shade-loving plants, a striking exception is found in the case of the "Gold fern," *Gymnogramme chrysophylla*, which thrives to perfection in Colombo in the full glare of the tropical sun, attaining a large size when grown in tubs along paths or drives. Potting mixtures for ferns should consist mainly of fibrous loam and leaf-mould in equal proportions, to which should be added a small proportion of lime rubble or old mortar, and a similar quantity of

fine river sand; broken pieces of porous brick mixed with the soil are also a useful ingredient and have a beneficial effect in maintaining proper aeration of the soil. No manure should enter the potting compost unless it be in a thoroughly decomposed state. Thorough drainage being essential, the pots should be filled to about a quarter of their depth with crocks. Many of the more delicate ferns, such as Adiantums (Maiden-hair ferns) resent too much water overhead, so that their fronds should not be unnecessarily wetted. Ferns are generally easily multiplied by division of the roots, and those that produce fertile fronds may be propagated by spores. See under *Propagation.*

The following are some of the most ornamental ferns suitable for cultivation in the tropics.

FERNS SUITED FOR THE LOW-COUNTRY :—

*Acrostichum aureum. Karang or Kéré [koku; sea-coast.
Adiantum concinnum. "Maiden-hair" [Fern
A.—cuneatum.
A.—Farleyense.
A.—Fergusoni.
*A.—hispidulum.
A.—Pacottii.
A.—Peruvianum.
A.—trapeziforme.
A.—wiegandtii
Anemia Phyllitidis.
Asplenium falcatum.
*A.—lunulatum.
*A.—Nidus. "Bird's nest" Fern.
*A.—sylvaticum.
A.—tenerum.
*Blechnum occidentale.
*Cheilanthus tenuifolia.
Davallia Fijiensis.
*D.—pulchra.
D.—tenuifolia.
Dicksonia flaccida.
Didymochlaena lunulata.
*Gleichenia dichotoma.
Gymnogramme chrysophylla. Gold Fern
G.—pulchella. Silver Fern
G.—schizophylla.
Lomaria gibba.
Nephrodium macrophylla.
*N.—molle.
N.—decurrens.
*Nephrolepis cordifolia.
N.—davallioides.
*N.—Duffii.
*N.—exaltata.
N.—tripinnatifida.
*Ophioglossum pendulum.
Platycerium alicorne. "Elk's Horn" [Fern
*Polypodium quercifolium. "Bain- [duru," S.
P.—verrucosum.
Pteris argyræa.
P.—cretica alba-lineata.
*P.—ensiformis.
*P.—quadriaurita.
P.—serrulata.

PLANTS RELATED TO FERNS, SUITED FOR THE LOW-COUNTRY :—

*Azoll pinnata. (See *Water Plants*)
*Lycopodium cernuum. "Badal-wanassa," S.
*L.—Phlegmaria. "Maha-hedaya," S.
*L.—Hookeri. "Kuda-hedaya," S.
L.—squarrosum.
*L.—zeylanicum.
*Marsilea quadrifolia. (See *Water* [*Plants*)
Selaginella amœna.
Selaginella caulescens.
*S.—crassipes.
S.—grandis.
S.—lævigata.
S.—Martensii.
S.—M.—variegata.
S.—uncinata.
S.—Wildenovii.

*Indigenous to Ceylon.

VIEW IN FERNERY, HAKGALA GARDENS, CEYLON.
Showing tree-ferns, chiefly *Alsophila crinita*, in foreground.

Ferns suited for Up-country (3,000 to 6,000 Ft.) :—

*Adiantum capillus-veneris. Maiden-hair Fern
A.—cuneatum.
A.—Fergusoni.
A.—gracillimum. Finest-leaved Maiden-hair Fern
*Cheilanthus farinosa.
*Diacalpe aspidioides.
*Davallia bullata.
*D.—majuscula.
*Lomaria Patersoni and L. Gibba.
*Nephrodium flaccida.
*N—Walkerae.
*Angiopteris evecta.
*Aspidium aculeatum.
*A.—anomalum.
Asplenium bulbiferum.
*A.—tenuifolium.
*Blechnum orientale.
*Nephrodium zeylanica.
*Nephrolepis cordifolia.
*Osmunda Javanica.
*Polypodium rufescens.
*Pteris incisa.
P.—Victoriae.
*Stenoloma chinensis. Parsley Fern.

Tree Ferns :—

*Alsophila crinita. Wooly Tree-Fern
*A.—glabra.
*Amphicosmea. See *Hemitelia*.
Cyathea dealbata. Silver Tree-Fern
*Cyathea Hookeri.
*C.—sinuata.
Dicksonia antartica.
*Hemitelia Walkerae.

ORNAMENTAL FOLIAGE POT-PLANTS

Suited also for Shaded Borders up to 2,000 or 3,000 ft.

[C=cuttings; S=seed; Div.=division; Su.=suckers; Tu.=tubers].

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height and descriptive notes.
Acalypha godseffiana. New Guinea	*Euphorbiaceae*	C.	2—3 ft. Leaves margined with white.
Aechmea fulgens. Guiana	*Bromeliaceae*	Offsets	1 ft. } Stemless plants with stiff sheathing leaves.
A.—mexicana. Mexico	,,	,,	2 ,,
A.—Skinneri. Guatemala	,,	,,	1½ ,,
A.—Weilbachii. Brazil	,,	,,	1½ ,,
Aglaonema costatum. Perak	*Aroideae*	Div.	6 in. } Herbaceous plants with fleshly variegated or blotched leaves.
A.—Haenkii. Philippines	,,	C	2 ft.
A.—Marantifolium. Malaya	,,	C. or Div.	2 ,,
A.—pictum. Malaya	,,	,,	1—2 ft.
A.—versicolor.	,,	,,	1 ft.
Alloplectus Lynchii. Colombia	*Gesneraceae*	C	1½ ft. L. bronze-coloured.
Alocasia Argyrea. Hab?	*Aroideae*	Tu. or Offsets.	2 ft. L. with grey bands.
A.—cuprea. Borneo	,,	,,	1—2 ft. L. coppery green.
A.—Johnstoni See *Cyrtosperma*			
A.—Lindeni. Papua	,,	,,	2 ft.
A.—longiloba. Malaya	,,	,,	6—10 ft. L. very large, deeply cut lobes. Stem 5 to 6 ft., erect.

*Indigenous to Ceylon.

ANTHURIUM WAROCQUEANUM.

Name and Native Country. [Hort.=Of garden origin]	Natural Order.	How Propagated.	Height and descriptive notes.
A.—**macrorhiza variegata.** Ceylon, etc	*Aroideae*	Div. or C	5 ft. L. large, broad, blotched with white.
A.—**princeps.** Malaya	,,	,,	2 ft.
A.—**sanderiana.** Philippines	,,	,,	2 ft. Margins and veins marked with prominent silver bands; sinuate.
A.—**violacea.**	,,	,,	2 ft. L. metallic blue.
A.—**zebrina.** Manila	,,	,,	3 ft. L. sagittate, dark-green bands
Anœctochilus setaceus "Wana-raja" S. Ceylon. Several other species.	*Orchideae*	Tubers.	½ ft. Velvety green leaves, with golden veins.
Ananas sativus variegatus. Variegated Pine-apple	*Bromeliaceae*	Offsets.	1½ ft. L. variegated pinkish-white.

S.=Sinhalese

ANTHURIUM VEITCHII.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated	Height and descriptive notes.
Anthurium andreanum. Colombia	*Aroideae*	C. or Offsets.	3—5 ft. Large, satiny, very handsome leaves.
A.—bogotense. Colombia	,,	,,	2 ft. L. curiously 3—lobed.
A.—crassinervium.	,,	,,	3—4 ft L. radical, obovate, upright.
A.—cristallinum. Peru	,,	,,	2—3 ft. L. large, white silvery veins.
A.—digitatum. Peru	,,	,,	2—3 ft.
A.—Fitzeri.	,,	,,	L. large, 4 to 5 ft. long, similar to A. warocqueanum.
A.—Harrisii. Brazil	,,	,,	2 ft.
A.—longifolium. Brazil	,,	,,	1½ ft.
A.—macrolobum. Hort	,,	,,	3 ft.
A.—pandulifolium. Brazil	,,	,,	L. 5—8 ft. long by 6—8 in. broad.
A.—radiatum. Mexico	,,	,,	3 ft. L. radially digitate.
A.—Veitchii. Colombia	,,	,,	2½ ft. long, L. furrowed transversely.
A.—Warocqueanum. Colombia	,,	,,	Leaves 2—3 ft. long.
Aralia Balfourii. Hort	*Araliaceae*	C	3—4 ft. Quick-growing plants with handsome deeply cut leaves.
A.—elegantissima. Polynesia	,,	,,	2—3 ,,
A.—filicifolia.	,,	,,	4—6 ,,
A.—triloba.	,,	,,	2—3 ,,
A.—Veitchii. New Caledonia	,,	,,	2—3 ,,
Arundinacea suberecta.	*Gramineae*	Div.	1—1½ ft. Small bamboo-like plant with drooping foliage.
Asarum geophyllum. China	*Aristolochiaceae*	,,	½ ft. L. round, variegated
Aspidistra lurida variegata. Japan	*Liliaceae*	,,	1½ ft. Large variegated radical, erect leaves.
Begonia albo-picta. Brazil	*Begoniaceae*	C	1½ ft. L. spotted white.
B.—gogoensis. Sumatra	,,	,,	1 ft. L. peltate.
B.—grandis.	,,	,,	1—2 ft. L. velvety, with pale spots.
B.—Haageana. Brazil	,,	,,	3 ft.
B.—heracleifolia Mexico	,,	,,	1½ ft.
B.—metallica. Mexico	,,	,,	3 ft. L. bronzy purple.
B.—purpurea.	,,	,,	2 ft. L. deep bronzy purple.
B.—President de Bourenilles Hort	,,	,,	1½—2 ft. L. deep bronzy purple.
B.—rex. Numerous varieties	,,	,,	1 ft. L. beautifully marked.
B.—sceptrum. Brazil	,,	,,	2—3 ft. L. spotted grey.
B.—tomentosa. Brazil See *Flowering Plants for Pots*	,,	,,	1½—2 ft. L. tomentose.
Bertolonia marmorata. Brazil	*Melastomaceae*	,,	6—10 in. Beautiful shade-loving plants, with delicate velvety leaves.
B.—superba. Madagascar	,,	,,	1 ft.
Bilbergia rosea. Trop. America	*Bromeliaceae*	S. or offsets.	2—3 ft. Epiphytic plants with long convolute leaves; purple or bronze, blotched with grey.
B.—sanderiana. Brazil	,,	,,	1½ ft.
B.—speciosa. ,,	,,	,,	1½ ft.

ANTHURIUM PANDULIFOLIUM.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height and descriptive notes.
Bowenia spectabilis. Queensland	*Cycadeae*	Su. or S	2—3 ft. Large, bipinnate, fern-like leaves.
Caladium. See *Bulbous and Tuberous Plants*			
*Calathea arrecta. Eucador	*Scitamineae*	Div.	3 ft. L. velvety bronze.
C.—grandifolia. Brazil	,,	,,	2 ft. L. large, round.
C.—Leitzii. Brazil	,,	,,	1½ ft. Erect habit; l. small.
C.—Lindeniana. Peru	,,	,,	2—3 ft. L. beautifully marked on both sides.
C.—sanderiana. Brazil	,,	,,	1 ft. L. lined with pink.
C.—Makoyana. Trop. America	,,	,,	½ ft. L. with curious rounded blotches.
C.—medeo-picta. Brazil	,,	,,	1½ ft.
C.—Veitchii Bolivia	,,	,,	2—3 ft. L. blotched, purple beneath.
C.—Veitchiana. Brazil	,,	,,	1 ft. L. variegated, purple beneath.
C.—zebrina. "Zebra Plant." Brazil	,,	,,	2—3 ft. L. velvety, banded dark and light green.
Caraguata andreana. Colombia	*Bromeliaceae*	Su. & div.	2 ft. } Stiff convolute leaves, prettily marked.
C.—musaica. Colombia	,,	,,	1 ft.
C.—Zahnii. Chiriqui	,,	,,	1 ft.
Carludovica palmata. Panama-hat Plant S. America	*Cyclanthaceae*	Su. or S	4—6 ft. } Palm-like stemless plants.
C.—Plumerii. S. America	,,	,,	4—6 ft.
Centradenia rosea. Mexico	*Melastomacéae*	C or div.	1 ft. Pinkish leaves.
Chamaeranthemum argenteum. New Britain	*Acanthaceae*	C	1½—2 ft. L. variegated.
C.—pictum. Brazil	,,	,,	1½ ft.
Clinogyne grandis. Malaya	*Scitamineae*	Div.	3—4 ft.
Conocephalus suaveolens. Malaya	*Urticaceae*	C	4—6 ft.
Cordyline australis. New Zealand	*Liliaceae*	Su. or C.	10 ft. } Palm-like plants; l. green, crimson or purple.
C.—indivisa. New Zealand	,,	,,	10 ft.
C.—terminalis. Numerous varieties	,,	,,	5—8 ft. L. purple and crimson.
Costus afer. Sierra Leone	*Scitamineae*	Div.	3—4 ft. Fl's white.
C.—elegans. Costa Rica	,,	,,	2 ft. L. velvety with dark bands.
C.—igneus. See *Flowering Plants for Pots*	,,	,,	
C.—musaicus. Trop. America	,,	,,	1½—2 ft. L. small, narrow, margined with grey.
C.—pictus. Mexico	,,	,,	4—6 ft. L. satiny green, glaucous beneath.
Cryptanthus Beuckeri. Brazil	*Bromeliaceae*	Su	8 in. L. stiff, in rosette.
C.—zebrinus. Brazil	,,	,,	8 in. Transverse bands of dark green.
C.—zonatus. Brazil	,,	,,	6—8 in.
Curculigo recurvata. Trop. Asia	*Amaryllideae*	Div. or S	3 ft. Palm-like plant.

*Leaves close up at night.

ANTHURIUM CRISTALLINUM. Silver-leaved Anthurium.

Name and Native Country. [Hort = Of garden origin].	Natural Order.	How Propagated.	Height and descriptive notes.
C.—recurvata variegata.	*Amaryllideae*	Div. or S	3 ft. Variegated form of above.
Curmeria. See *Homalomena*			
Cycas circinalis. "Madu" S. Ceylon and India	*Cycadaceae*	Offsets or S	3—12 ft. Palm-like plants with large feathery leaves.
C.—revoluta. China	,,	,,	3—4 ft.
Cyclanthus cristatus. Colombia	*Cyclanthaceae*	Div.	5—6 ft. Large radical leaves.
Cyperus alternifolius. "Umbrella Plant," Madagascar	*Cyperaceae*	,,	3—4 ft. } Quick-growing plants; feathery leaves.
C.—alternifolius variegatus. Hort	,,	,,	2—2½ ft. }

S.=Sinhalese

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated	Height and descriptive notes.
C.—Papyrus. Papyrus Grass. Palestine, etc.	*Cyperaceae*	Div.	6—8 ft. Requires much moisture, and thrives best in a swamp.
Cyrtosperma Johnstonii. Solomon Islands	*Aroideae*	,,	4—8 ft. L. large, arrow-shaped, veined with rosy red, stalks mottled, spiny
Dichorisandra mosaica. Peru	*Commelinaceae*	Div. or C	6 in. L. with mosaic-like white lines.
D.—undata. Peru	,,	C	6 in. L. undulated, striped with grey.
D.—thyrsiflora. Brazil	,,	,,	See *Flowering Plants for Pots.*
D.—vittata. Hort	,,	,,	6 in. L. purplish green; grey stripes.
Dieffenbachia Bowmanni. Brazil	*Aroideae*	C or Su	2—3 ft. } Dumb-canes. Handsome quick-growing fleshy herbaceous plants, with leaves variously blotched or variegated.
D.—eburnea. Brazil	,,	,,	
D.—Jenmani. Brit. Guiana	,,	,,	
D.—Leopoldii. S. America	,,	,,	
D.—magnifica. Venezuela	,,	,,	
D.—Memoria-Cortii. Hort	,,	,,	
D.—picta. Brazil	,,	,,	
D.—splendens. Colombia	,,	,,	
Dorstenia argentata. Brazil	*Urticaceae*	Div.	1 ft. L. with central silvery band.
Dracaena Godseffiana. W. Trop. Africa	*Liliaceae*	C of Stem or S	3—4 ft. Shrub with variegated leaves.
D.—Goldieana. ,,	,,	,,	6 ft. L. with yellow bands.
D.—Sanderiana. W. Trop. Africa	,,	,,	1—1½ ft. L. slender, streaked with white.
D.—Victoria. W. Trop. Africa	,,	,,	2—4 ft. L. broad, recurved, white with green stripe in centre.
Dracontium (Godwinia). See *Bulbous and Tuberous Plants.*			
Elatostema lineolatum majus Ceylon	*Urticaceae*	C	1 ft. Herb, with leaves much cut.
Episcia cupreata. Nicaragua	*Gesneraceae*	,,	1½ ft. } Bronze-coloured leaves.
E.—(Centrosolenia) tessellata. Peru	,,	,,	1½ ft.
Eranthemum atropurpureum. Polynesia	*Acanthaceae*	,,	} Shrubs with variegated and coloured leaves 4—8 ft. high.
E.—eldorado. Polynesia	,,	,,	
E.—tricolor. ,,	,,	,,	
E.—versicolor ,,	,,	,,	
Fittonia argyroneura. Peru	,,	,,	6 in. L. white-veined.
F.—gigantea. Eucador	,,	,,	1½ ft. } L. oval, purplish with pink veins.
F.—verschaffeltii. Brazil	,,	,,	8 in.
Garnotia Fergusonii var fastigiata.	*Gramineae*	Div.	1½ ft.; graceful, slender bushy grass.
Gymnostachyum zeylanicum. Ceylon	*Acanthaceae*	C	8 in. L. oval, pink veins.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height and descriptive notes.
Heliconia aureo-striata New Britain	*Scitamineae*	Div.	4—6 ft. Plantain-like plants.
H.—illustris Hort	,,	,,	4—6 ft. L. with yellow veins.
H.—spectabilis. Trop. America	,,	,,	4—6 ft. L. large, bronze.
Hoffmannia discolor. Mexico	*Rubiaceae*	C	½ ft. L. bronze, satiny green
H.—(Higginsia) Ghiesbreghtii. Mexico	,,	,,	1½—2 ft. Leaves variegated, tender, lanceolate.
Hoffmannia (Higginsia) refulgens. S. America	,,	,,	1—2 ft. L. deep bronze
Homalomena picturata. Colombia	*Aroideae*	Div.	1 ft. } Ornamental variegated leaves
H.—rubescens. India	,,	,,	2 ft. }
H.—Wallisi. Colombia	,,	,,	1½ ft. }
Jacaranda filicifolia. Panama	*Bignoniaceae*	S or C	2—6 ft. Ornamental fern-like foliage
Kaemperia Gilbertii. Burma	*Scitamineae*	Div.	½ ft. Leaves banded with white
Kalanchoe flammea. "Life Plant." Somaliland	*Crassulaceae*	C	1 ft. L. succulent, deeply cut
Karatas fulgens. Brazil	*Bromeliaceae*	Offsets	1 ft. } Sheathing leaves, growing in the form of a bird's nest
K.—Innocentii striata. Hort	,,	,,	1 ft. }
K.—spectabilis. Brazil	,,	,,	1 ft. }
Ledenbergia roseo-aenea. Central America	*Phytolaccaceae*	C	1—2 ft. L. coppery-green, violet underneath
Leea amabilis var. splendens.	*Ampelideae*	,,	3—4 ft. L. bronzy-green, white central band
Ludovia crenifolia. Brazil	*Cyclanthaceae*	Div.	3—4 ft. Palm-like plant
Macrozamia Fraseri. Australia	*Cycadeae*	Offsets or S.	3—5 ft. } Graceful fern-like plants
M.—Moorei ,,	,,	,,	3—5 ft. }
Maranta imperialis	*Scitamineae*	Div.	2—3 ft. } Stemless plants with large, beautifully marked leaves; these close up towards the centre at night
M.—insignis	,,	,,	1 ft. }
M.—makoyana	,,	,,	½ ft. }
M.—Massangeanum	,,	,,	½ ft. }
M.—picta	,,	,,	}
M.—polita	,,	,,	1 ft. }
M.—sangoreana. Hort	,,	,,	1½ ft. }
M.—tigrina	,,	,,	1 ft. }
Nephthytis picturata. Congo	*Aroideae*	,,	1½ ft. L. large, handsomely marked with dark satiny bands
Ophiopogon intermedium. Ceylon, India, etc.	*Haemodoraceae*	,,	1 ft. } Grass-like leaves; specially suited for shaded situations
O.—japonicus Japan	,,	,,	1 ft. }
O.—japonicus variegatus. Japan	,,	,,	1 ft. }
Oxalis bupleurifolia. Brazil	*Geraniaceae*	C	1—1½ ft. Leaf-like petioles
Panax crispum. Brazil	*Araliaceae*	,,	2—3 ft. L. pinnate
P.—elegans. Australia	,,	,,	2—3 ft. L. pinnate
P.—multifidum.	,,	,,	1 ft. L. like parsley
Pandanus Sanderi.	*Pandanaceae*	Offsets	3—6 ft. Handsome variegated leaves

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height and descriptive notes.
Pandanus Veitchii. Polynesia	*Pandanaceae*	Offsets	2—3 ft. Like P. sanderi, but less hardy.
Panicum plicatum. Trop. Asia, &c.	*Gramineae*	Div.	2 ft. A grass with long furrowed broad leaves.
Pandanophyllum (Mapania) Wendlandii	*Cyperaceae*	,,	Grass-like plant.
Peliosanthes Teta. India.	*Haemodoraceae*	Div. or S	1 ft. Stemless; l. plicate
Pellionia daveauana. Cochin China.	*Urticaceae*	C	½—1 ft. } Creeper L. variegated, oval, fleshy.
P.—pulchra. Cochin China.	,,	,,	½ ft. } Creeper L. variegated, oval, fleshy.
Peperomia argyreia. S. America	*Piperaceae*	Div. or C	1 ft. } Succulent variegated oval leaves
P.—Fraseri. ,,	,,	,,	10 in. } Succulent variegated oval leaves
P.—magnifica. Hort	,,	,,	1 ft. } Succulent variegated oval leaves
P.—Saundersii. Brazil	,,	,,	10 in. } Succulent variegated oval leaves
Phalaris arundinacea variegatus.	*Gramineae*	,,	10 in. See *Bamboos and Grasses*
Philodendron andreanum. Colombia	*Aroideae*	C	3—5 ft. Large beautiful velvety leaves
P.—gloriosum. ,,	,,	,,	2—3 ft. L. large, cordate, white veins and pink margins.
P.—Mamei. Eucador	,,	,,	2—3 ft. L. variegated, large, cordate
P.—Selloum. Brazil	,,	,,	2—3 ft. L. handsomely cut
Phrynium variegatum. Variegated Arrowroot	*Scitamineae*	Div. or Tu.	2 ft. L. handsomely variegated
Phyllanthus nivosus. Polynesia	*Euphorbiaceae*	C	2 ft. L. mottled with white
Phyllotaenium (Xanthosoma) Lindeni. Colombia	*Aroideae*	Div.	1½ ft. L. large, handsome, sagittate, with white veins
Pothos. See *Ornamental Climbers for Pots.*			
Rhœo discolor. Central America	*Commelinaceae*	C	1 ft. Leaves with purple edges, also underneath
Ruellia colorata. Moluccas	*Acanthaceae*	,,	½ ft. L. copper-coloured
Sansevieria cylindrica. Trop. Africa	*Haemodoraceae*	Div. or leaf-C	3—4 ft. L. cylindrical, erect
S.—guineensis. Trop. Africa	,,	,,	3 ft. } L. flat, sword-shaped.
S.—zeylanica. Ceylon, India, etc.	,,	,,	3 ft. } L. flat, sword-shaped.
Schismatoglottis decora. Borneo	*Aroideae*	Div.	½ ft. L. lanceolate, handsomely variegated.
S.—neoguineensis. New Guinea	,,	,,	1 ft. L. large, oval, blotched with grey.
S.—picta. Java	,,	,,	1 ft. L. dark-green, 2 grey bands.
S.—siamensis. Siam	,,	,,	1 ft. L. lanceolate, spotted grey.
Schizocasia (Alocasia) Portei. New Guinea	,,	,,	5—8 ft. L. large, pinnatifid, sagittate.
Stangeria paradoxa. Natal	*Cycadeae*	Offsets	3 ft. Handsome fern-like plant.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated	Height and descriptive notes.
Stenandrium Lindeni. Brazil	*Acanthaceae*	C	1 ft. Variegated leaves.
Steudnera colocasiaefolia. Martaban	*Aroideae*	Div.	2 ft. Leaves peltate, oval
S.—discolor. India	,,	,,	2 ft. L. peltate, blotched with purple beneath
Strobilanthes dyerianus. Burma	*Acanthaceae*	C	1—2 ft. Crimson velvety leaves; requires shade
Syngonium podophyllum albo-lineatum.	*Aroideae*	Div.	8 in. Leaves pinnate, variegated.
Tillandsia pulchella. Brazil	*Bromeliaceae*	Offsets	1 ft. Epiphytes; ornamental- coloured leaves.
T.—splendens. Guiana	,,	,,	1 ft. L. with transverse violet bands.
Tradescantia fuscata. Brazil	*Commelinaceae*	C or Div.	½ ft. L. clothed with dark red hairs.
T.—reginae. Hort	,,	C	1 ft. L. mottled white with violet centre.
Zamioculcas Loddigesii. Trop. Africa	*Arodieae*	Div.	Pinnate leaves, 2—3 ft. long
Zebrina pendula. Mexico	*Commelinaceae*	C	Small herbaceous creeper with ornamental variegated foliage.
Zeuxine regia. "Iru-raja" S. Ceylon	*Orchideae*	Tubers	½ ft. L. dark green, with white line down centre.
Zingiber D'arceyi. "Variegated Ginger"	*Scitamineae*	,,	2 ft. L. radical, variegated.

FLOWERING POT-PLANTS

Suitable for Shaded Situations up to 2,000 or 3,000 Ft.

[C.=cuttings; S.=seeds; Div.=division; Su.=suckers].

Name and Native Country [Hort.=Of garden origin]	Natural Order.	How Propagated.	Height, Colour of Flowers, etc.
Acalypha sanderiana. Papua	*Euphorbiaceae*	C	4—5 ft. Fl's in long crimson pendant tails.
Achimenes. See *Bulbous and Tuberous Plants*			
Æchmea fulgens. Guiana (Epiphytes)	*Bromeliaceae*	Offsets	2½ ft. Deep rich red.
Æ.—paniculigera. W. Indies (Epiphytes)	*Bromeliaceae*	Offsets	1—2 ft. Rose-coloured.
Æ.—spectabilis. Guatemala (Epiphytes)	*Bromeliaceae*	Offsets	2½ ft. ,,
Æschynanthus Hildebrandii. Burma	*Gesneraceae*	C	½ ft. Scarlet, tipped with black.
Amydrium humile. Borneo	*Aroideae*	Div.	½ ft. White.
Anthurium Archduke Joseph. Hort	,,	Offsets or S	2 ft. Bright rose.
A.—carneum. Hort	,,	,,	Light rose colour.
A.—chelseiense. Hort	,,	,,	1½ ft. Crimson.
A.—desmetianum. Hort	,,	,,	2 ft. Carmine-scarlet.

S.=Sinhalese

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height, Colour of Flowers, etc.
A.—ferrierense. Hort	*Aroideae*	Offsets or S	2 ft. Bright-red.
A.—scherzerianum. Guatemala Numerous varieties and hybrids	,,	,,	1 ft. Spathe large, scarlet, or crimson, etc. Spadix spiral
Aphelandra nitens. Colombia	*Acanthaceae*	C	1½ ft. Leaves shining, dark green ; fl's scarlet.
Centropogon lucyanus. Hort	*Campanulaceae*	,,	1½ ft. Crimson, tubular.
Clerodendron macrosiphon. Zanzibar	*Verbenaceae*	,,	2—3 ft. Snow-white.
Cochliostema jacobianum Eucador	*Commelinaceae*	Div.	1½ ft. Fl's in large head, blue and pink.
Costus igneus. Brazil	*Scitamineae*	,,	2 ft. Bright orange ; leaves purple beneath.
Cyanotis barbata. Nepal	*Commelinaceae*	Div. or C	½ ft. Blue.
C.—kewensis. Travancore	,,	,,	½ ft. Pink.
Dalechampia roezliana. Mexico	*Euphorbiaceae*	C	2—3 ft. Pink and yellow.
Dichorisandra thyrsiflora. Brazil	*Commelinaceae*	,,	3 ft. Bright-blue
Euadenia eminens. W Trop. Africa	*Capparideae*	,,	1½ ft. Large, pale-yellow flowers
Griffinia hyacinthina. Brazil	*Amaryllideae*	Div.	1 ft. Beautiful blue, clustrd.
Impatiens flaccida var. Ceylon	*Geraniaceae*	C. or S	1 ft. White
I.—mirabilis. Malaya	,,	C	2—3 ft. Yellow
I.—repens. "Gal-demata" Ceylon	,,	,,	Stems creeping. Fl's bright yellow
I—sultani. Zanzibar	,,	C. or S	1 ft. Scarlet
Isoloma. See *Bulbous and Tuberous Plants*			
Karatas Innocentii. Brazil	*Bromeliaceae*	Offsets	1 ft. Bright orange-red
K.—spectabilis ,,	,,	,,	1 ft. Red and violet-blue
Musa coccinea. "Flowering Banana." China	*Scitamineae*	Su.	3—5 ft. Spathes bright red
Nematanthus longipes. Brazil	*Gesneraceae*	C	2 ft. Scarlet
Pitcairnea alta. W. Indies	*Bromeliaceae*	Div. or Su.	3 ft. Red; long loose sprays.
P.—cœrulea. Chili.	,,	,,	3 ft. Blue
P.—corallina. Colombia	,,	,,	2 ft. Crimson
P.—muscosa. Brazil	,,	,,	1 ft. Red
Saintpaulia ionantha "African Violet," Central Africa	*Gesneraceae*	Leaf-C or div.	½ ft. Beautiful violet-blue flowers; l. hairy, round or heart-shaped, fleshy.
Sceutellaria mociniana. Mexico	*Labiatae*	S or div.	1½ ft. Scarlet.
S.—violacea. Ceylon, etc.	,,	,,	1 ft. Violet-purple.
Siphocampylus elegans. New Grenada	*Campanulaceae*	C	2 ft. Bright red.
S.—tovariensis. Venezuela	,,	,,	2 ft. Scarlet.
Spathiphyllum candidum. Colombia	*Aroideae*	Div.	1 ft. White, scented.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Height, Colour of Flowers, etc.
S.—cannæfolium. Trop. America	*Aroideae*	Div.	1 ft. White.
S.—Patnii. Colombia	,,	,,	1 ft. White.
Spironema fragrans. Mexico	*Commelinaceae*	S & Div.	1 ft. White; spiral stamens.
Strelitzia augusta. "Bird of Paradise" Flower; S. Africa	*Scitamineae*	Su. or Div.	6—10 ft. White, crimson and purple.
S.—regina. S. Africa	,,	,,	3—5 ft. Orange and purple.
Tacca cristata. Trop. Asia	*Taccaceae*	Div.	2 ft. Brownish-purple.
Tillandsia Lindeni. Peru	*Bromeliaceae*	Div. & Su.	1½ ft. Violet, bracts rosy.
T.—nitida. Jamaica	,,	,,	2 ft. Blue; l. convolute.
T.—pulchra. Trop. America	,,	,,	1 ft. Pink.
T.—(Vriesia) recurvifolia.	,,	,,	1 ft. Blue, bracts rosy-purple.
T.—Roezlii. Peru	,,	,,	1½ ft. Rosy.

ORNAMENTAL CLIMBERS ADAPTED FOR GROWING IN POTS

Suitable for Low Elevations.

[C.=cuttings; S.=seed; Tu.=tubers; Div.=division].

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Remarks.
Antigonon leptopus. Mexico	*Polygonaceae*	S or C	Beautiful bright-pink fl's.
A.—leptopus albiflora.	,,	,,	White flowers.
Aristolochia elegans. Brazil	*Aristolochiaceae*	,,	Fl's saucer-shaped, curiously marked.
Asparagus plumosus. "Asparagus Fern" S. Afr.	*Liliaceae*	S or Tu.	Handsome delicate foliage
A.—Sprengeri. Natal	,,	,,	Coarser foliage, l. larger.
Cissus discolor. Bengal	*Ampelideae*	C	Young l. velvety-purple.
Dichorisandra thyrsiflora. Brazil	*Commelinaceae*	C or Div.	Beautiful deep-blue fl's.
Dioscorea argyrea. Colombia	*Dioscoraceae*	Tu.	Large variegated leaves
D.—multicolor. Trop. America	,,	,,	,, ,,
Gloriosa superba. Trop. Asia and Africa	*Liliaceae*	,,	Fl's large, beautiful orange-red.
Hoya carnosa. "Wax Flower." Trop. Asia	*Asclepiadeae*	C	Fl's in clusters, wax-like; also a variegated variety
Manettia bicolor. Brazil	*Rubiaceae*	,,	Small twiner. Fl's scarlet and yellow.
Marcgravia paradoxa. Hort	,,	,,	Large handsome flat leaves, closely adhering to walls.
Paullinia thalictrifolia. S. America	*Sapindaceae*	,,	Small twiner; leaves very like Adiantum.
Philodendron squamiferum.	*Aroideae*	,,	L. lobed, petioles with fleshy pinkish spines.

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	How Propagated.	Remarks.
Philodendron carderi. Hort	*Aroideae*	C	L. Delicate satiny-green, with dark bands.
Pothos argenteus. Borneo	,,	,,	Silvery leaves.
P.—reticulata.	,,	,,	L. heart-shaped, spotted pale green.
Smilax argyrea. Bolivia	*Liliaceae*	Div.	L. blotched with white
Stephanotis floribunda.	*Asclepiadeae*	C	Fl's tubular, waxy-white, scented.

SELECTED ORNAMENTAL PLANTS OR SHRUBS INDIGENOUS TO CEYLON.

(For Palms, Orchids and Ferns, see under their respective heads).

S.=Shrub. A.=Annual. H. P.=Herbaceous Perennial. T.=Tree. Cl.=Climber. Cr.=Creeper. W. Cl.=Wooly Climber.

Name.	Natural Order.	See above.	Remarks.
Abutilon asiaticum. "Anoda." (L.c.)	*Malvaceae*	S	2—4 ft.; fl's yellow.
Aeschynanthus zeylanica. (U.c.)	*Gesneraceae*	P Cr.	2—2½ ft.; fl's orange-yellow
Alocasia macrorhiza variegata (L.c.)	*Aroideae*	H P	3—4 ft.; very large variegated hastate leaves.
Alpinia nutans var. sericea. "Rankiriya." (L.c.)	*Scitamineae*	H P	5—6 ft. Large leaves; fl's pinkish white.
Alyxia zeylanica. (L c.)	*Apocynaceae*	S	3—5 ft.; fl's pale yellow.
Amorphopallus campanulatus. "Kidaran." (L.c.)	*Aroideae*	H P	Tuberous; very large leaves and fl's; fl. fœtid
Aneilema giganteum. (L.c.)	*Commelinaceae*	H P	3 ft.; fl's pale blue.
Anœctochilus regalis. "Wanaraja" (Moist region; I.e.)	*Orchideae*	H P	Ground orchid; beautifully marked leaves. Moist shaded places.
Ardisia missionis. (L.c.)	*Myrsineae*	S	6—8 ft.; fl's in clusters, pale pink.
Barleria involucrata. (U.c.)	*Acanthaceae*	S	3—4 ft.; fl's brilliant purple-blue.
B.—mysorensis. "Katunelu." (Dry region)	,,	S	3 ft.; fl's bright violet-blue.
B.—Prionitis. "Katukarandu" (Dry region)	,,	S	2—3 ft.; fl's bright pale orange-yellow.
Berberis aristata. (U.c.)	*Berberidae*	S	5—6 ft. fl's bright yellow.
Burmannia disticha. "Ma-diya-jawala." (L.c.)	*Burmanniaceae*	H P	1—1½ ft. fl's. bright blue.
Calophanes Nagchana. (Dry region)	*Acanthaceae*	S	3 ft.; fl's pale blue.
Capparis zeylanica. (Dry region)	*Capparideae*	S	6—8 ft. Beautiful pink and white fl's.

L.c.=Low-country generally. U.c.=Up-country. I.e.=Intermediate elevation.

Name.	Natural Order.	See heading.	Remarks.
Cassia auriculata. "Ranawara." (Dry region)	*Leguminosae*	S	4—6 ft.; fl's bright yellow.
Cassia occidentale. "Peni-tora." (U.c.)	,,	S	3—4 ft.; fl's bright orange yellow.
Chirita Moonii. (L.c.)	*Gesneraceae*	S	2—3 ft. Large mauve-violet fl's; on rocks.
Clerodendron serratum. "Ken-henda." (L.c)	*Verbenaceae*	S	4—8 ft.; fl's purplish blue.
Clitoria ternatea. "Nil-katarodu." (L.c.)	*Leguminosae*	A. Cl.	8—10 ft.; fl's bright blue.
Costus speciosus. "Tebu" (L.c.)	*Scitamineae*	H. P.	4—5 ft.; fl's white and yellow; showy leaves.
Crossandra undulæfolia. (L.c.)	*Acanthaceae*	S	2 ft.; fl's salmon-yellow.
Crotolaria Walkeri. (U.c.)	*Leguminosae*	S	4 to 6 ft.; fl's striated yellow.
Curculigo recurvata. "Waga-pol." (L.c.)	*Amaryllideae*	H. P.	2—3 ft. Large palm like leaves.
Cyanotis obtusa. L.c.	*Commelinaceae*	H. P.	1 ft.; fl's violet-blue.
Cycas circinalis. "Madu" (L.c.)	*Cycadeae*	T	10—15 ft. Palm-like feathery leaves.
Cynoglossum micranthus. (U.c.)	*Boragineae*	H. P.	2—3 ft.; fl's deep blue.
Cyphostigma pulchellum. (L.c.)	*Scitamineae*	H. P.	6—10 in.; fl's bright pale pink.
Datura fastuosa. "Attana" U.c.	*Solanaceae*	A	2—3 ft.; fl's large, white.
Dædalacanthus montanus. (I.e.)	*Acanthaceae*	S	2—3 ft.; fl's pale violet-blue.
Dianella ensifolia. (L.c.)	*Liliaceae*	H. P.	3—5 ft.; fl's pale-blue, followed by pretty blue berries.
Didymocarpus zeylanicus. U.c.	*Gesneraceae*	H. P.	½ ft.; fl's white and purple.
Ferns, See Ceylon Ferns	—	—	—
Exacum macranthum. (U.c. open patnas)	*Gentianaceae*	A	1—2 ft.; fl's large, deep purplish blue.
Filicium decipiens. 'Pehimbia." (L.c.)	*Burseraceae*	T	Ornamental as small plants; fern-like leaves.
Gloriosa superba. "Niyangalla" (L.c.)	*Liliaceae*	H. Cl.	4—6 ft.; large handsome orange yellow fl's.
Glossocarya scandens. (Dry region)	*Verbenaceae*	W. Cl.	Fl's white; a beautiful climber or bush.
Gymnostachyum zeylanicum. (L.c.)	*Acanthaceae*	H. P.	½ ft. Leaves variegated with white veins.
Hedyotis Lawsoniæ. (U.c)	*Rubiaceae*	S	5—7 ft.; fl's white.
Hibiscus angulosus var grandiflorus. (U.c.)	*Malvaceae*	H. P.	5—6 ft.; fl's large, bright yellow with brown eye.
Humboldtia laurifolia. "Gal-karanda." (L.c.)	*Leguminosae*	S. or T	12—15 ft.; fl's pinkish white, scented.
Hypericum mysorense. (U.c.)	*Hypericaceae*	S	5—8 ft.; fl's bright yellow.
Impatiens acaulis. (U.c.)	*Geraniaceae*	H P	8—12 in. Fl's bright rosy pink.
I.—cuspidata bipartita. (U.c.)	,,	,,	3—5 ft.; fl's pale pink or nearly white.

L.c.=Low-country generally. U.c.=Up-country. I.e.=Intermediate elevation.

Name.	Natural Order.	See heading.	Remarks.
I.—elongata. (U.c.)	*Geraniaceae*	H P	About 2 ft.; whole plant tinged with red; fl's bright rose-pink.
I.—flaccida. "Kudalu-mal." (L.c.)	,,	A	2 ft.; fl's bright mauve and pink; also a pure white variety.
I.—Hookeriana. (U.c.)	,,	H P	3—5 ft.; fl's large, white, veined with red.
I.—leptopoda. (U.c.)	,,	A	2—3 ft.; fl's pale pink, in season all the year.
I.—repens. "Gal-demata" (L.c.)	,,	Cr.	Fl's bright yellow.
I.—Walkeri. (U.c.)	,,	H	2—3 ft.; fl's pale scarlet, sometimes yellow.
Ipomæa Bona-nox. "Alanga."	*Convolvulaceae*	W. Cl.	L. large, fl's white.
I.—palmata.	,,	,,	L. compound, fl's dull violet
Ixora coccinea. (L.c.)	*Rubiaceae*	S	4-6 ft.; fl's scarlet, v. showy.
I.—jucunda. (L.c.)	,,	S	10—12 ft.; fl's bright coral red.
Jussiæa suffruticosa. (L.c.)	*Onagraceae*	H P	4 ft.; fl's yellow.
Justicia betonica. "Sudu-puruk" (L.c.)	*Acanthaceae*	S	4 ft. Pale violet.
Kendrickia walkeri (U.c.)	*Melastomaceae*	Cl.	Fl's bright rose; epiphytic climbing shrub, v. showy.
Klugia notoniana. "Dyanilla." (U.c.)	*Gesneraceae*	A	1 ft.; fl's deep blue.
Lawsonia alba. Tree Mignonette (Dry region)	*Lythraceae*	S	5—6 ft.; fl's creamy white, scented.
Melastoma malabathricum. Maha-bowitiya. (L.c.)	*Melastomaceae*	,,	10—12 ft.; fl's violet-mauve
Memecylon umbellatum. Kora-kaha. (L.c.)	,,	,,	7—8 ft.; fl's bright blue, all along the branches.
Mundulea suberosa "Gal-burutu." (Dry region)	*Leguminosae*	S or T	10—15 ft; fl's bright pinkish violet.
Nepenthes distillatoria. Pitcher plant; "Bandura-wel." *S.* (L.c)	*Nepenthaceae*	Cl.	5—8 ft. Elongation of leaf-tips formed into pitchers.
Ophiopogon intermedius. (L.c.)	*Haemodoraceae*	H P	1 ft. Grass-like leaves; moist shady places. Fl's dingy white.
Osbeckia buxifolia. (U.c.)	*Melastomaceae*	S	4—6 ft.; fl's rich mauve
O.—rubicunda. (U.c.)	,,	S	4—6 ft.; fl's brilliant purplish crimson.
Oxystelma esculentum "Kulap-palai," *T.* (Dry region)	*Asclepiadeae*	H P	Semi-aquatic; fl's veined with pink.
Palms, See *Ceylon Palms*			
Pavetta indica. (U.c.)	*Rubiaceae*	S	4—6 ft.; fl's white, profuse.
Phyllanthus myrtifolius. a Ceylon Myrtle. (L.c.)	*Euphorbiaceae*	S	6—8 ft.; small myrtle-like leaves; fl's purplish red.
Plumbago zeylanica. "Ela-netul." (L.c.)	*Plumbagineae*	S	2—3 ft.; fl's white
Rhaphidophora decursiva. "Dada-kehel." (I.e.)	*Aroideae*	Cr.	30—40 ft. Large spreading, deeply cut leaves.

L.c.=Low-country generally. U.c.=Up-country I.e.=Intermediate elevation. *T.*=Tamil

Name.	Natural Order.	See heading.	Remarks.
Rhododendron arboreum.	*Ericaceae*	T	Large showy fl's; Ap.-July.
Rivea ornata. "Muchuddai," *T.* (Dry region)	*Convolvulaceae*	Cl.	On rocks in dry districts; fl's white, scented.
Sansevieria zeylanica. "Niyanda." (L.c. & dry region)	*Haemodoraceae*	H. P.	2—3 ft. Sword-shaped variegated succulent leaves.
Sophora tomentosa. "Mudu-murunga." (L.c.)	*Leguminosae*	S	8—10 ft. Foliage grey tomentose.
S.—violacea. (L.c.)	"	S	3 ft. Fl's violet.
Stachytarpheta mutabilis. "Balu-nakutu." (L.c. and dry region)	*Verbenaceae*	H. P.	2—3 ft. ; fl's pink.
Strobilanthes helicoides. (U.c.)	*Acanthaceae*	S	3—5 ft. Fl's violet with white tube; very showy.
S.—Hookerii. (U.c.)	"	S	2—4 ft.; fl's pure white, with purple veins.
S.—pulcherrimus. (U.c.)	"	S	3—6 ft. Fl's pale pink and violet.
Tephrosia maxima. (Dry region)	*Leguminosae*	H. P.	1—2 ft. Fl's bright pale-pink.
Thespesia Lampas. (Dry region)	*Malvaceae*	S	6—8 ft.; fl's bright yellow, crimson centre
Torenia asiatica. "Kotala-wel." (U.c.)	*Scrophulariaceae*	Cr	Fl's dark purple, tube pale yellow.
Vaccinium Leschenaultii. "Boralu," *S.* (U.c.)	*Vacciniaceae*	S or T	8—12 ft.; fl's bright dark pink; Feb., Mar. & Sept.
Woodfordia floribunda. "Malitta." (I.e.)	*Lythraceae*	S	6—8 ft. ; fl's orange red.
Wrightia zeylanica. "Sudu-idda." (L.c.)	*Apocynaceae*	S	3—6 ft.; fl's waxy, pure white.

L.c.=Low-country generally. U.c.=Up-country. I.e.=Intermediate elevation.
S=Sinhalese, *T*=Tamil.

CHAPTER XVIII.

SELECTIONS OF ORNAMENTAL PLANTS, TREES, ETC., SUITABLE FOR UP-COUNTRY.

ORNAMENTAL FLOWERING TREES:—

[S.=Sinhalese ; *T.*=Tamil].

Acacia dealbata. (*Leguminosae*). "Silver Wattle."—A small Australian tree with finely cut leaves, distinguished from other species of the same genus by the silvery-white under-side of the leaves. Very ornamental when in flower, viz., during February to March and July to August, with its large heads of yellow fragrant blossom. An objection to the tree, however, is its habit of sending up numerous suckers, which are difficult to eradicate. Commonly grown at hill stations in India and Ceylon. Propagated by seed or suckers.

A.—Baileyana.—A beautiful flowering and foliage tree of New South Wales, characterized by slender shoots and bluish-green leaves, not unlike *A. dealbata*. It bears very long sprays of rich yellow flowers, and is grown in France commercially for the sake of the latter. The tree is grown on Fairfield Estate, Lindula, and elsewhere in Ceylon.

A.—cultiformis. (Knife-formed, in reference to the form of the phyllodes). "Knife-leaved Acacia."—A small tree or large shrub, with pale yellow flowers, produced in the dry weather twice a year, and small oblong glaucous phyllodes which end in a small sharp prickle. The tree is also ornamental on account of its foliage.

A.—decurrens. (Running down, in allusion to the union of the leaves with the stem). Common, or Black Wattle. A large Australian tree, well-established at Hakgala and elsewhere up-country; yields a valuable tanning bark and useful timber. It is a quick-grower, reaching a height of 40 to 50 feet in a few years, and its fragrant yellow flowers, produced in the dry months, render it an ornamental tree. The seeds are small, 1,790 weighing only an ounce.

A.—longifolia. (Long-leaved). "Sydney Golden Wattle."—A small spreading tree, very ornamental when in blossom, viz., during February to March, and July to August, the flowers being pale-yellow.

A.—pycnantha. (Dense-flowered). "Golden Wattle" or "Broad-leaved Wattle."—A medium-sized tree, with undivided leaves (*phyllodes*), native of Southern Australia. Very ornamental during the dry season, when it bears masses of yellow blossom. It has flowered in Hakgala Gardens when only two or three years old. For tanning purposes, its bark ranks as one of the most valuable of Wattle-barks.

Callistemon lanceolata. (*Myrtaceae*). Bottle-brush Tree.—A small tree with stiff, narrow leaves, native of Australia. It blossoms all the year round, but chiefly after the rains, when its scarlet flowers, crowded on spikes of the old wood in the form of a brush, are very attractive. Propagated by seed, which are very minute and should be sown in pots.

Calophyllum Walkeri. (*Guttiferae*). "Kina," *S.*—This is the familiar mountain "Kina" of Ceylon, a large handsome tree with stiff coriaceous leaves, bearing from January to April a profusion of pinkish-white, sweet-scented flowers. It is of slow growth, and is propagated by seed.

Elæocarpus glandulifera. (*Tiliaceae*).—A medium-sized tree, very handsome when in blossom, being then literally covered with racemes of creamy-white flowers.

Eucalyptus ficifolia. (*Myrtaceae*). Scarlet-flowering Gum Tree.—A small tree, native of South-West Australia, perhaps the most showy of the Eucalyptus family. Von Mueller mentions it as "worthy of cultivation for the sake of its magnificent trusses of crimson flowers, irrespective of its claims as a shade or avenue tree."

Hymenosporum flavum. (*Pittosporaceae*).—A small tree of Eastern Australia, introduced about 1882 into Hakgala Gardens, Ceylon, where it is now well established. It bears during the dry weather a profusion of small pale-yellow flowers. Propagated by seed.

Meliosma Arnottiana. (*Sabiaceae*).—A moderate-sized tree, indigenous to the montane zone of Ceylon; it bears a profusion of creamy-white flowers in April, being deciduous in January. Dr. Trimen said of it: "A great ornament to the montane forests when covered with its sheets of cream-coloured blossoms."

Pittosporum undulatum. (*Pittosporaceae*). "Victorian Laurel."—A small Australian tree, introduced and established at Hakgala Gardens, bearing in March or April a profusion of fragrant cream-coloured flowers.

STENOCARPUS SINUATUS. FLOWERS SCARLET.

Rhododendron arboreum. (*Ericaceae*). "Maha-ratmal" *S.*—A small tree, 15 to 30 feet high, common in a wild state in the montane zone of Ceylon above 5,000 feet. Very conspicuous when bearing its large dark-crimson or pink flowers, from April to July.

Stenocarpus sinuatus. (*Proteaceae*). "Fire Tree" or "Tulip Tree" of Queensland.—An erect tree, 40 to 50 feet high, very showy when bearing its large clusters of scarlet flowers. It has been established in Peradeniya Gardens since 1883, also at Hakgala Gardens. Flowers during the dry weather, but has not yet set fruit in Ceylon. Suited to elevations of 1,500 to 4,000 feet.

Sterculia acerifolia. (*Sterculiaceae*). "Flame Tree."—A moderate-sized tree with large shining, angular leaves, native of Southern Australia, introduced into Ceylon in 1882. In cool shade, it grows and flowers at comparatively low elevations, but is more suited to the higher altitudes, thriving up to 5,500 feet in Ceylon. It produces in May and June, when bare of leaves, large masses of brilliant red blossom. Propagated by cuttings, or by seed when procurable.

ORNAMENTAL FOLIAGE TREES.

Acacia decurrens. (*Leguminosae*). Black or Tan Wattle.—A handsome tree, 40 to 60 feet high, native chiefly of Eastern Australia; thrives between 4,000 and 6,000 feet on poor land, but grows best in rich soil. The tree has of late become popular at the higher elevations in Ceylon for planting amongst Tea for the purpose of green-manuring or windbreaks; it affords excellent fuel. (See *Up-country Flowering trees.*)

A.—Melanoxylon. Blackwood Tree, or "Leafless Acacia."—A large handsome tree, native of Southern Australia, characterized by usually having phyllodes only for leaves, rarely bearing pinnate leaves except in the young state. It furnishes a handsome and excellent timber, "one of the best in Victoria for railway carriages, etc." The late Mr. J. K. Nock stated: "Wood splits well for shingles; the tree is a greedy feeder, roots spreading a considerable distance, being consequently injurious to any plants growing near it."

Acrocarpus fraxinifolius. (*Leguminosae*). A medium-sized tree with feathery foliage which is of a beautiful crimson tint when young, usually about February. Introduced from India into Hakgala Gardens about 1890.

Agathis (Dammara) robusta. See *Foliage Trees for Low and Medium elevations.*

Ailanthus glandulosus. (*Simarubaceae*).—A very handsome tree, 50 to 60 ft. high, with long pinnate leaves.

Araucaria Bidwillii. (*Coniferae*). "Monkey Puzzle."—A large stately tree with flat scale-like, stiff, pointed leaves; grows to a

great height in its native country. Thrives at Hakgala Gardens, Ceylon. See *Foliage Trees for Low elevations.*

A.—Cookii. See *Foliage Trees for Low elevations.*

A.—Cunninghamii. Moreton-Bay Pine.—A tall, erect tree of Eastern Australia, etc., with short, rather slender, branches. Very graceful.

A.—excelsa. Norfolk Island Pine.—A beautiful symmetrical tree, with regular tiers of short horizontal spreading branches, attaining to a great height; grown in Europe as an ornamental pot-plant in hot-houses. Thrives at Hakgala. See *Foliage Trees for Low elevations.*

Bucklandia populnifolia. (*Hamamelideae*).—A handsome tree, with large leathery, glossy leaves, native of the Himalayas. Thrives at Hakgala Gardens.

Castanospermum australe. (*Leguminosae*). Moreton Bay Chestnut.—A moderate-sized tree with handsome pinnate leaves, native of Queensland.

Casuarina torulosa. (*Casuarineae*). She-Oak, or Beef-wood. —A handsome leafless tree, with cord-like branchlets representing leaves. Of several species, this is one of the most suited to the higher elevations.

Cedrela Toona. (*Meliaceae*). Red Cedar, Indian Mahogany.—A very handsome tree on account of its long graceful, pinnate leaves, which when young are of a crimson tint. It grows to a height of 40 to 50 feet, and yields fine timber, which is of commercial importance.

Chamaecyparis Lawsoniana. (*Coniferae*). "Funeral" or "Weeping" Cypress.—An elegant tree with graceful drooping branchlets; a favourite for planting in cemeteries.

C.—Knightiana.—A very elegant tall tree, with drooping feathery branchlets, distinguished by a glaucous hue. It is a native of Mexico, and has become thoroughly established at the higher elevations in Ceylon.

C.—Lawsoniana.—See *Chamaecyparis.*

C.—macrocarpa. "Monterey Cypress."—A large, handsome, quick-growing tree, similar to *C. Knightiana*, but distinguished from it by its more vertical and pointed branches, also darker hue.

C.—pyramidalis.—A tall tree with somewhat erect whippy branches, considered to be a variety of the following species.

C.—sempervirens. Common Cypress.—A pyramid-shaped tree, with horizontal branches and feathery drooping foliage, native of South Europe, where it grows to a great height. It is especially ornamental in a young state. Thrives up-country.

Elæocarpus glandulifera.—A medium-sized tree with striking foliage. See *Flowering Trees for Up-country.*

Eucalyptus citriodora. (Myrtaceae). Lemon-scented Gum-tree.—A handsome slender tree with a smooth white bark, native of Queensland. Its leaves have an agreeable lemon-scented odour

E. globulus. Blue Gum-tree. A large tree, commonly grown up-country for fuel and windbelts. Very handsome on account of the glaucous-blue colour of the young leaves. Thrives best between 4,000 and 6,000 feet. Propagated by seed.

Ficus macrophylla. (Urticacea). Moreton Bay Fig.—A Queensland tree, with large leathery leaves; thrives in sheltered situations up to 6,000 ft.

Frenela (Callitris) rhomboidea. (*Coniferae*).—An elegant Cypress-like tree, native of Australia, introduced and acclimatised at Hakgala Gardens, Ceylon, where it bears seeds freely. Very ornamental for lawns, etc.

Gordonia anomalum. (*Ternstromiaceae*).—A medium-sized handsome foliage tree, indigenous to the hill forests of Ceylon. Dr. Trimen stated: "Very rare: I fear that extensive clearings have exterminated this fine species in most places."

Grevillea robusta. (*Proteaceae*). Silky Oak.—A medium-sized tree, introduced into Ceylon from Australia in 1856, and extensively planted up-country amongst Tea for shade, as well as for fuel and wind-breaks. The pretty, fern-like leaves are silvery white beneath and render the tree very ornamental. The tree does not thrive well under 1,000 feet. Propagated by seed.

Juniperus Bermudiana. (*Coniferae*). Bermuda Cedar.—A medium-sized tree, with leaves of two forms. It thrives at elevations of 4,000 to 6,000 ft., and attains a height of 30 to 40 ft. at Hakgala Gardens.

Melaleuca leucadendron. (*Myrtaceae*). "Tea Tree" of Australia.—A large tree, with graceful foliage and curious fibrous-scaly bark, which may be pulled off in large sheets.

Pinus canariensis. (*Coniferae*). Canary Island Pine. An excellent pine for high elevations in the tropics and for sub-tropical regions. In its native home, the Canary Islands, it grows from sea-level to 9,000 ft. altitude. It is being extensively planted in

S. Africa, and is preferred to all other pines in Chili. The wood is remarkably durable, and the stumps send out new shoots when cut down.

P.—insignis. Monterey Pine.—A Californian pine-tree, thrives best at elevations of 4,000 to 6,000 ft. It was first introduced at Peradeniya in 1868.

P.—longifolia.—An Indian pine-tree, remarkable for its long, slender, pendulous leaves, which are 12 to 14 inches in length. Established at Hakgala Gardens.

P.—Montezumoe.—A large handsome pine-tree of Japan, with long spreading branches, introduced at Hakgala Gardens about 1880, and now well-established there. Leaves very long, in bunches of nine.

Rhodoleia Championi. (N. O. *Hamamelideae*).—A medium-sized spreading tree, with glaucous-grey foliage and bright-red flowers. It is a native of Hong-Kong, and has become quite established in Hakgala Gardens.

Schinus molle. (*Anacardiaceae*). Pepper Tree.—A small spreading handsome tree with fine pinnate leaves, native of temperate South America. It is best adapted to medium elevations in the tropics and to sub-tropical climates. It is one of the most beautiful of ornamental shade trees, and the foliage when cut may be used for decorative purposes. Propagated from seed or cuttings.

S.—terebinthifolius, native of Brazil, is similar to the above and a useful ornamental tree. Introduced to Peradeniya in 1884.

Syncarpia laurifolia. (*Myrtaceae*). Turpentine-tree of Queensland.—A tall handsome quick-growing tree, of an erect symmetrical habit. Yields excellent timber. Established at Hakgala Gardens, where it bears seed.

Tristania conferta (*Myrtaceae*). Queensland Box-wood.—A very handsome tree, with smooth shiny pointed leaves, suited to the higher elevations. It attains a great height, is suitable for avenues, and yields excellent timber.

FLOWERING SHRUBS AND HERBACEOUS PERENNIALS

Suited for Up-country.

[C.=cuttings; S.=seed; Div.=division; Su.=suckers; L.=layers].

Name.	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet. etc.
Abelia chinensis	*Caprifoliaceae*	Pink	C	5—6
A —grandiflora	,,	White	,,	,,
A.—rupestris	,,	Pinkish-white	,,	,,

Name.	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Abutilon, "Boule de Niege"	*Malvaceae*	White	C	4—5
A —"Golden Fleece." Numerous species & var's.	,,	Yellow	,,	5—6
Allamanda Schottii	*Apocynaceae*	,,	C or S	3—5
Aloe Hanburyana. Numerous other species	*Liliaceae*	Coral-red	S. or Su.	1—1½
Althaea rosea. Hollyhock	*Malvaceae*	Rose-pink, etc.	Div. & S	3—5
Azalia, different varieties	*Ericaceae*	Red, Pink, White	L	2—5
Begonia fuchsioides	*Begoniaceae*	Crimson	C	2—3
Beloperone oblongata	*Acanthaceae*	Bright-pink	,,	4—5
Bellis perennis. Daisy	*Compositae*	White or Pink	Div.	¼
Berberis cristata. Barberry	*Berberidae*	Yellow	C	3—4
B.—Fortunei	,,	,,	,,	3—4
B.—leschenaultii	,,	Yellow	C or S	10—20
Brugmansia, see *Datura*	—	—	—	—
Brunfelsia uniflora (= *Franciscea bicolor*)	*Solanaceae*	Blue & white	C	4—5
Calliandra Guildingii	*Mimosae*	Pink	C or S	5—8
Callistemon brachyandrus	*Myrtaceae*	Yellow	,,	5—6
C.—lanceolatus	,,	Crimson	,,	5—6
Camellia, numerous varieties	*Ternstromiaceae*	White, pink, etc.	Layers	8—15
Campanula longifolia	*Campanulaceae*	Blue	C or S	2—3
C.—medium. "Canterbury Bells"	,,	Blue & white	,,	,,
Cestrum aurantiaca	*Solanaceae*	Yellow	,,	5—6
C.—elegans	,,	Crimson	,,	,,
Choisya ternata. "Mexican Orange"	*Rutaceae*	White	C	4—5
Chrysanthemum pinnatifidum	*Compositae*	White	C or S	2½—3
C.—sinensis Numerous varieties	,,	White, pink, crimson, yellow.	,,	,,
Cotoneaster Simmondsii	*Rosaceae*	Red berries	,,	3—4
Cuphea jorullensis	*Lythraceae*	Yellow	C or Div.	2
C.—platycentra. "Cigar Flower"	,,	Red	C Div. or S	1—1½
Cyphomandra fragrans	*Solanaceae*	Bluish-white	C or S	10—12
Datura coccinea. Thorn-apple	,,	Scarlet	C	4—6
D.—chlorantha fl. pleno	,,	Yellow	,,	6—8 } Double fl's
D.—Knightii. "Trumpet Flower"	,,	White	,,	8—12 } Double fl's
Delphinium hybridum	*Ranunculaceae*	Blue	Div. or S	3—4
Digitalis canariensis	*Scrophulariaceae*	Yellow	S or Div.	2—3
D.—purpurea. Foxglove	,,	Purple	,,	,,
Duranta Ellisii. "Duranta"	*Verbenaceae*	White	C or S	8—12
D.—Plumieri	,,	Pale-blue	,,	8—10
Eupatorium riparia	*Compositae*	Red	C	5—6
E.—Weinmanianum	,,	Whitish	,,	6—8 scented
Euphorbia splendens	*Euphorbiaceae*	Rose-scarlet	,,	3—4
Franciscea bicolor, see *Brunfelsia*	—	—	—	—

DELPHINIUM HYBRIDUM (SUTTON'S) FLOWERS BRIGHT BLUE.

Name	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Fuchsia arborescens. "Tree Fuchsia"	*Onagraceae*	Lilac	C or S	8--12
F.—corymbosa	,,	Scarlet	,,	6 – 8

Name.	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc
Genista canariensis. Cape broom.	*Leguminoseae*	Yellow	C or S	3—4
Habrothamnus, see *Cestrum*	—	—	—	—
Heliotropium. Heliotrope, "Cherry Pie." Different varieties	*Boragineae*	Blue shades	C	3—4
Hibiscus rosa-sinensis. Shoe-flower. Numerous var's	*Malvaceae*	Scarlet	,,	8—12
		Shades of red, white, yellow.	,,	6—12
H.—syriacus.	,,	Bluish-purple	,,	4—6
Hydrangea hortensis. Hydrange	*Saxifragaceae*	Blue, white or pink	,,	$1\frac{1}{2}$—3
Hypericum canariensis	*Hypericineae*	Yellow	S or C	5—6
H.—mysorense	,,	,,	,,	8—10
Impatiens elongata	*Geraniaceae*	Bright rose-pink	C	2
I.—Hookeriana	,,	White, veined with red	,,	3—4
I.—Walkeri	,,	Scarlet	Div.	2—3
Jasminum pubescens.	*Oleaceae*	White	C	6—8
J.—revolutum	,,	Yellow	,,	,,
J.—Sambac	,,	White	,,	5—6
Kniphofia aloides. (=Tritoma uvaria) Torch Lily or Red-hot-poker	*Liliaceae*	Scarlet	—	3—4
Laurustinus, see *Viburnum*	—	—	—	
Libonia floribunda	*Acanthaceae*	Orange-yellow	C	2—4
Lobelia cardinalis. "Cardinal Flower."	*Campanulaceae*	Scarlet	C or S	3—4
Magnolia fuscata. "Madanakam Poo" *T.*	*Magnoliaceae*	Cream	,,	8—10 Fl's strongly scented
M.—grandiflora	,,	White	Layers	10—15
Montanoa bipinnatifida. "Tree Daisy."	*Compositae*	,,	C	8—12
Moraea iridioides	*Irideae*	Blue & white	Div. or S	2
Musa coccinea. "Flowering Banana."	*Scitamineae*	Scarlet	Su. or S	5—6
Nandina domestica.	*Berberideae*	Pinkish	C	3—4
Nierembergia gracilis. "Cup Flower."	,,	White & Yellow	C or S	2—3
Notelaea liquestrina	*Oleaceae*	Pinkish	C or Su.	1—$1\frac{1}{2}$
Philadelphus coronarius. Mock orange	*Saxifragaceae*	Creamy-white	C	6—7
Phlomis floccosa	*Labiateae*	Yellow	,,	2
Pleroma macranthum	*Melastomaceae*	Violet-blue	C or S	6—10
Plumbago capensis	*Plumbagineae*	Light-blue	C or div.	3—4
Polygonum chinense	*Polygonaceae*	Creamy-white	C	5—7
Reinwardtia trigyna	*Linaceae*	Yellow	,,	3—4
R.—tetragyna	,,	,,	,,	3—4
Rhododendron, numerous species and varieties	*Ericaceae*	Pink, crimson, white, etc.	S	3—6
R.—arboreum. Ceylon Rhododendron	,,	Crimson	,,	15—30

T.=Tamil

Name.	Natural Order.	Colour of Flowers.	How Propagated.	Height in feet, etc.
Spiroea media	*Rosaceae*	White	C or div.	4—5
S.—peruviana	,,	,,	,,	5—6
Stevia Eupatoria	*Compositae*	Dingy white	C	5—7
Streptocarpus, numerous spp. and var's.	*Gesneraceae*	Lilac, mauve white, etc.	S	½
Streptosolen Jamesoni. Flame flower	*Solanaceae*	Orange-yellow	C or S	4—5
Strobilanthes gossypinus. (See *Foliage Plants*)	*Acanthaceae*	Lilac or Blue	C	4—5
Tecoma capensis	*Bignoniaceae*	Scarlet	,,	4—6
T.—Smithiana	,,	Orange red	,,	6—8
T.—Stans	,,	Yellow	S or C	10—20
"Tree Daisy," See *Montanoa*	—	—	—	—
Viburnum tinus. "Laurustinus."	*Caprifoliaceae*	White	C	5—7 Fl's scented.
Wiganda Vigieri	*Hydrophyllaceae*	Dark-blue	C or Su.	8—10
Vittadenia triloba. Australian Daisy	*Compositae*	White	C	½—1

ORNAMENTAL
FOLIAGE SHRUBS AND HERBACEOUS PERENNIALS

Suited for Up-country

[C.=cuttings; S.=seed; Div.=Division; Su.=suckers].

Name.	Natural Order.	How Propagated.	Height in feet, etc.
Abutilon Thompsonii	*Malvaceae*	C	3—4 Variegated leaves.
Acalypha marginata	*Euphorbiaceae*	,,	4—5
Acanthus ilicifolius	*Acanthaceae*	Div. or S	3 Holly-like leaves.
A.—mollis	,,	,,	3—4
Agapanthus variegatus	*Liliaceae*	Div.	1—1½
Agave americana variegata. Numerous species & var's.	*Amaryllideae*	Su. or bulbils	6—10
Aloysia (Lippia) citriodora. "Sweet-scented Verbena."	*Verbenaceae*	C	2—3
American Aloe, see *Agave*	—	—	—
Anthericum liliastrum "St. Bruno's Lily"	*Liliaceae*	Div.	1 Variegated foliage
Bambusa aurea	*Gramineae*	,,	10—15 Yellow stems.
B.—Fortunei variegata	,,	,,	1 Variegated foliage.
B.—nana. See *Bamboos & Ornamental Grasses*	,,	,,	8
Bay Laurel, see *Laurus*		—	—
Beaucarnea longifolia. Mexico	*Liliaceae*	S	6—8 Large swollen base.
Begonia, fibrous-rooted. Numerous spp. & var's	*Begoniaceae*	C or div.	3—4

Strobilanthes gossypinus.

Name.	Natural Order.	How Propagated.	Height in feet, etc.
Berberis Fortunei variegata	*Berberidae*	C	4—5
Bocconia frutescens. "John Crow Bush"	*Papavaraceae*	C or S	8—12
Buxus sempervirens. Boxwood	*Euphorbiaceae*	C	½—6
Cerasus Lauro-cerasus. Laurel Cherry	*Rosaceae*	,,	8—10
Cineraria maritima. "Cotton Lavender," see *Santolina*	*Compositae*	S or C	1 Silvery foliage
Dielytra (Dicentra) spectabilis Lyre Flower	*Fumariaceae*	C	1—1½
Doryanthes palmerii. Spear Lily	*Amaryllideae*	Su. or S	6—8
Echeveria metalica. "Oyster Plant"	*Crassulaceae*	Div. or Su.	3 in } Small succulent rosette-like plants. Suited for edgings
E.—secunda	,,	,,	3 ,,
Furcræa gigantea. Mauritius Hemp. See *Succulent Plants*	*Amaryllideae*	Bulbils or Su.	6—8
Iresine Herbstii	*Amarantaceae*	C	2—3
I.—Lindeni	,,	,,	1½—2
Laurus nobilis. Bay Laurel	*Lauraceae*	,,	6—8

Name.	Natural Order.	How Propagated.	Height in feet, etc.
Libertia, see *Bulbous Plants, etc.*	—	—	—
Leucadendron argentium. "Silver-leaf" of S. Africa	*Proteaceae*	C or S	6—10 Prized for the silvery white leaves
Melianthus major. "Honey Shrub"	*Sapindaceae*	C or div.	3—4
Musa coccinea "Flowering" or Chinese Banana	*Scitamineae*	Su. or S.	5—6
Musa Ensete. Abyssinian Banana	,,	S	8—9
Myrtus communis. Myrtle	*Myrtaceae*	C	8—10
Nolina, see *Baucarnea*	—	—	—
Periwinkle, see *Vinca*	—	—	—
Phormium tenax. New Zealand Flax	*Liliaceae*	Div.	5—6 L. variegated, sword-shaped.
Podocarpus macrophylla.	*Coniferae*	S or C	6—8
Prunus lusitanica. Portugal Laurel	*Rosaceae*	C	6—12
Santolina chamæcyparisus. Cotton Lavender	*Compositae*	C or div.	1 Pale-grey foliage, strongly scented.
Strobilanthes gossypinus.	*Acanthaceae*	C	4—5 Fol. grey tomentose.
Vinca minor. Variegated Periwinkle	*Apocynaceae*	C	1

ORNAMENTAL CLIMBERS AND CREEPERS

Suitable for Up-country

[C.=cuttings; S=seed; L.=layers].

Name and Native Country [Hort.=Of garden origin]	Natural Order.	Colour of Fl's., etc.	How Propagated.	Position suited for.
Abronia umbellata (Annual) California	*Nyctagineae*	Lilac or pink	C	Hanging-pots
Allamanda Hendersoni. Brit. Guiana	*Apocynaceae*	Yellow, large	,,	Trees, fence, etc.
Ampelopsis Veitchii. "Virginian Creeper." Japan	*Ampelideae*	Leaves bronze	,,	Walls or pillars
Begonia fuchsioides. New Grenada	*Begoniaceae*	Scarlet	,,	Pillar, verandah, etc.
Bignonia capreolata. N. America	*Bignoniaceae*	Pink & yellow	,,	Arbours & arches
B.— venusta. "Tanga-poo," *T.*	,,	Orange-yellow	,,	Arbours & arches
Bomarea carderi. Columbia	*Amaryllideae*	Bright pink and white	,,	Pillars, etc.
Bougainvillea spectabilis. S. America	*Nyctagineae*	Purple	,,	Trees, banks, etc.
Cassia viminea. W. Indies	*Leguminosae*	Yellow	,,	Trees, pillars, etc.
Clematis, several spp. and varieties	*Ranunculaceae*	White, violet, blue, etc.	S	Walls, arbours, etc.

T.=Tamil

Name and Native Country. [Hort.=Of garden origin].	Natural Order.	Colour of Fl's., etc.	How Propagated.	Position suited for.
Cobæa scandens. Mexico	*Polemoniaceae*	Greenish purple	S & C	Tall trees, fences, etc.
Convolvulus, different var's.	*Convolvulaceae*	Various	S	Fences, arbours, etc.
Crotalaria semperflorens. Ceylon, etc.	*Leguminosae*	Yellow	S or C	Rockeries, etc.
Dumasia villosa. Nepaul	,,	,,	,,	Pillars & arbours
Ficus pumila (=F. repens.) Ceylon, etc.	*Urticaceae*	Small ornamental foliage	C	Creeper on walls
Fuchsia radicans. Brazil	*Onagraceae*	Scarlet	,,	Pillars, banks, etc.
Hardenbergia monophylla. Australia	*Leguminosae*	Blue	C or S	Hanging pots, etc.
Hedera Helix. Ivy. Britain	*Umbelliferae*	Handsome foliage	C	Creeper on walls
Hibbertia dentata. Australia	*Dilleniaceae*	Yellow	,,	L. entire, oval Trees or trellises
Hoya carnosa. Wax Flower.	*Asclepiadeae*	Pale-pink	,,	Sheltered pillars, trellis-work, etc.
Jasminum pubescens White Jasmine	*Oleaceae*	White	,,	
Ipomoea rubro coerulea Mexico	*Convolvulaceae*	Blue, pale centre	,,	
Lathyrus latiflorus. Perennial Pea. Britain	*Leguminosae*	Pink, etc.	S or C	Fences, walls, etc.
Lonicera caprifolia. European Honeysuckle	*Caprifoliaceae*	Yellowish	C	Tree-trunks, arbours, etc.
L.—Japonica. Japanese Honeysuckle	,,	Red & white	,,	
Lophosperma scandens	*Scrophulariaceae*	Pink	S	Trellis work, etc.
Mandevilla suaveolens. Buenos Ayres	*Apocynaceae*	White, scented	C or S	
Maurandya Barcklayana. Mexico	*Scrophulariaceae*	Violet-purple	,,	
M.—erubescens. Mexico	,,	Rose-pink	,,	
Mina lobata. (= Ipomœa versicolor) Mexico	*Convolvulaceae*	Orange-yellow, etc.	S or C	Dwarf slow-growing climber
Nasturtium, see *Tropaeolum*	—	—		
Passiflora edulis. Passion-flower. W. Indies	*Passifloraceae*	White	S	Fences, trees, etc.
Rhynchosperma cyanosperma	*Leguminosae*	Bright-red or white	,,	Rockeries, etc.
Roses, see article on *Roses*	*Rosaceae*	Various	C or L	Fences, arbours, etc.
Rubus (Bramble), several species	,,	Striking foliage	C or S	Trees, fences, etc.
Ruscus (Semele) androgynus. Canary Islands	*Liliaceae*	Handsome foliage (not true leaves)	C	Tall trees
Schmidia (Thunbergia) bicolor	*Acanthaceae*	Pink & yellow	,,	Arbours, arches, etc.
Senecio scandens. S. Africa	*Compositae*	White	,,	Fences, walls, or pillars
Smilax argyraea. Bolivia	*Liliaceae*	Variegated foliage	,,	Trees, etc.
S.—ornata	,,		,,	
Solandra grandiflora. Jamaica	*Solanaceae*	White	,,	Large trees
Solanum jasminoides. S. America	,,	,,	,,	Fences, arbours, arches, etc.

Name and Native Country [Hort.=Of garden origin].	Natural Order.	Colour of Fl's., etc.	How Propagated.	Position suited for.
Tacsonia mollissima. Quito	*Passifloraceae*	Pink	C	Pillars, arbours, etc.
T.—quitensis. Peru	,,	,,	S & C	
T.—van Volxemii. New Grenada	,,	Scarlet		
Tecoma jasminoides. Queensland	*Bignoniaceae*	Waxy-pink & white	C	
Thunbergia fragrans. Ceylon, etc.	*Acanthaceae*	Pure-white	S & C	Hanging pots, rockeries, etc.
Tropaeolum canariensis	*Geraniaceae*	Bright-yellow	S	Trellis-work, pillars, etc.
T.—majus. Nasturtium. Peru Also double varieties	,,	Orange-yellow	C or S	
T.—Lobbianum. Columbia	,,	Scarlet	S or Tu.	
Vinca minor. Periwinkle Europe	*Apocynaceae*	Blue	C	Rockeries and hanging pots.
V.—variegata. ,, ,,	,,	Variegated foliage	,,	
Wistaria sinensis. Japan	*Leguminosae*	Blue or purple	,,	Verandah walls and pillars

ROSES

One of the most satisfactory features of horticulture in the tropics is the fact that Roses—the "Queen of flowers"—can, with careful attention and selection of suitable varieties, be grown with a wonderful degree of success, not only in the hills, but also at all elevations down to sea-level. In the tropics, roses can usually be had in blossom all the year round, and in up-country gardens the size and quality of the blooms is frequently such as would compare well with those produced in temperate countries. Unfortunately, however, in equatorial regions, especially at low elevations, roses usually lack not only size and form of bloom, but also much of the delightful fragrance which is so characteristic of these flowers in cooler climes.

The following hints may be considered as preliminaries to success in growing roses: Choose a site with full exposure to the sun, shade from trees or houses being detrimental to the plants; protection from wind is necessary in the hills. A medium loamy soil with a clay sub-soil is best, while light sandy soils are the least suitable. Perfect drainage at the roots is essential. A liberal quantity of manure (preferably cow-manure in a well-decomposed state) should be worked into the soil, and the plants may be planted about 4 ft. apart each way in rows. If the land be flat, the soil

should be raised into beds or borders, so as to ensure good drainage. A mulching of stable manure, renewed at intervals, should cover the whole surface and sides of the beds ; this will protect the latter from the sun and retain moisture in the soil. Young plants should be chosen for planting out in preference to old ones. Any flower buds that may appear early should be removed, as the plants should not be allowed to bear blooms until at least 3 to 4 months after planting. In dry weather, the plants must be liberally watered.

Manuring.—Dung, when applied, should always be in a well-decomposed state ; otherwise grubs and termites will come in its wake. As a further precaution against these, a sprinkling of unslaked lime should be added to the manure before being forked into the soil. Castor cake forms an excellent manure for the growth of the plants, while phosphate fertilisers are considered important for the function of blooming. An expert grower recommends basic slag at the rate of $\frac{1}{2}$ to 1 lb. per plant, either alone, or incorporated with the dung when replenishing the beds. An application of liquid manure once or twice a week is most beneficial.

Pruning Roses.—As a general rule Tea, Noisette, and Bourbons, which are the only kinds suited to the low-country, do not need much pruning beyond the removal of worn out or dead wood. Branches that have made vigorous growth and have finished flowering should be cut back, otherwise the plants will assume a ragged and straggling appearance. The Hybrid Perpetual varieties are, however, generally benefited by a hard pruning, and this is best carried out, in the hill districts at any rate, towards the end of October; thus the new growth which follows should afford a display of bloom during the "hot season" months in the hills, viz., February to May.

Propagation.—This is invariably effected in the tropics by cuttings or layering, as plants on their own roots are the most adapted to the climate. Cuttings may be put down at any season, and they strike best in a soil consisting mainly of fine sand with an admixture of charcoal. It is customary to make the cuttings with a heel when possible, and it is best to insert them in the ground sloping-wise. They should be shaded and kept moist until new growth is visible. Layering is adopted in the case of varieties which do not propagate easily by cuttings, e.g. "Marechal Niel," and is successfully effected at Peradeniya all the year round. The layered shoot is pegged down into a bamboo-joint filled with fine

sandy soil, the new plant being thus easily removed when it has developed roots and become independent of the stock.

Roses in pots or tubs.—In the low-country and hot dry region, Roses generally do better in pots or wooden tubs than in an open border, owing to the unsuitable conditions of soil or climate. The former method enables the requirements of the plants to be better attended to, for the tubs can be filled with only the best soil and provided with efficient drainage, while the plants, being movable, may be afforded the most suitable spot in regard to light and shelter.

Diseases.—Roses are, on the whole, comparatively free from diseases in the tropics, mildew and "black spot," both fungus diseases, being perhaps the most prevalent. For the former, an occasional sprinkling of flowers of sulphur is a simple and effective remedy, and for the latter, which Mr. N. C. Rolt considers the worst enemy of the rose in Ceylon, formaldehyde diluted to a strength of 1/8 per cent, i.e., 1 tablespoonful to a gallon of soft water, has been found to be an excellent preventive.

Importing Roses.—When new plants or varieties are required, they should when practicable be obtained from a reliable firm at home, such as Messrs. Cant & Sons of The Old Rose Nurseries, Colchester, England. The plants being packed dry when in a dormant state, they take up but little space and can be transmitted in small packages by post. Though a good firm can be relied upon for sending the best varieties, it is well to remember that only roses on their own roots are adapted to the tropics, also that standard roses are not suitable. Small rooted cuttings travel well when their roots are in a ball of adhesive earth and surrounded by moss and waterproof paper; the stems, however, must have plenty of air, or will rot in transit. When imported plants arrive, especially if the weather be dry, they should be grown in bamboo-pots in the shade for a few weeks before being planted out.

VARIETIES

The success of rose cultivation in the tropics very largely depends on the kinds or varieties chosen. This is more especially true of the plains or low-country, where, as a rule, only "Teas," "Noisettes" and "Bourbons" will thrive. "Hybrid Perpetuals" may be considered generally as unsuited to elevations below 2,500 ft., and even in the hills may, with few exceptions, be superseded by the excellent Hybrid-Tea varieties now available.

DESCRIPTIVE LIST

[For elevations below 2,500 ft.: Those marked † are also suited for Up-country].

TEA-SCENTED ROSES:—

† **Adam.**—Rose and salmon, large blooms
† **Beaute Inconstante.**—Carmine yellow
Catherine Mermet.—Light-flesh, exquisite in form
† **Devoniensis.**—Creamy white, blush-centre
† **Enchantress.**—Creamy white, free bloomer
† **Etoile de Lyon.**—Sulphur-yellow. (Dry districts, up to 5,000 ft.)
† **Homer.**—Blush-rose and salmon
† **Hon. Edith Gifford.**—Flesh colour, white scented
Jean Ducher.—Yellow, salmon
La Boule d'or.—Golden-yellow
Lady Roberts.—Pink apricot, orange edges
Madame Camille.—Salmon-pink
„ de Watteville.—Salmon-rose
† **„ Lambard.**—Salmon-rose, free bloomer
† **Maman Cochet.**—Light pink, shaded salmon-yellow
† **Maman Cochet.**—White variety
Mrs. B. R. Cant.—Very vigorous, full, globular blooms; "always in bloom, also good for a fence"
† **Marie van Houtte.**—Creamy yellow, edged pink
† **Niphetos.**—Pure white
Peace.—Creamy white. "Makes a splendid bush, always in flower" (Rolt)
President.—Salmon-rose, large
† **Safrano.**—Coppery yellow

HYBRID TEAS:—

† **Admiral Dewey.**—Light blush
† **Betty.**—Exquisite, very large. Coppery-rose, shaded golden yellow
† **Captain Christy.**—Clear flesh, dark centre
Caroline Testout.—Salmon-pink
Clara Watson.—Salmon and pink
Clio.—White
Eearlute.—Scarlet-red, almost single; "one of the best bedders"
Gloire de Lyonnaise.—Lemon-yellow
† **Grace Darling.**—Large, full, rich pink
† **J. B. Clark.**—Rich scarlet, shaded dark crimson
† **Killarney.**—Pale pink
La France.—Silvery peach. (Dry districts up to 2,000 ft.)
† **Laurette Carle.**—Brilliant velvety carmine. "Splendid rose anywhere up-country. (Rolt)
Madame Abel Chatenay.—"Queen of decoratives." Salmon-pink
† **Richmond.**—Pure rich scarlet. Free bloomer
Viscountess Folkestone.—White, tinted with pale salmon, very large.
Warrior.—Blood red, good for massing

NOISETTES:—

† **Aimee Vibert.**—Pure white
† **Boule de Niege.**—Pure white
† **Caroline Kuster.**—Bright orange-yellow
Celine Forestier.—Rich sulphur—yellow
Cloth of Gold.—Yellow, pale margin
† **Lamarque Jeaune.**—Golden-yellow, large blooms
L'ideal.—Yellow or coppery-red
† **Reve d'Or.**—Deep-yellow, sometimes coppery yellow
† **William Allan Richardson.**—Orange-yellow or creamy-white

BOURBON:—

Apolline.—Light pink.
Empress Eugenie.—Rosy-blush, purple edges
Madame Plantier.—Pure white
† **Mrs. Paul.**—Blush white
† **Souvenir de la Malmaison.** (="Hundred-petal" rose).—Flesh colour
Victor Emmanuel.—Purplish maroon shade

HYBRID PERPETUAL ROSES:—

(FOR ELEVATIONS ABOVE 2,500 FT).

Abel Grand.—Rosy-blush
Charles Lefebre.—Crimson
Baron Rothschild.—Brilliant crimson
Baroness Rothschild.—Clear rose
Beauty of Waltham.—Rosy-crimson
Ben Cant.—Bright crimson
Black Prince.—Dark-crimson, shaded with black
Captain Hayward.—Carmine-red
Duke of Edinburgh.—Bright scarlet-crimson
Dupuy Jamain.—Bright cerise
Frau Karl Druschki.—Pure white, very large blooms
Her Majesty.—Satiny rose, large
Hugh Dickson.—Brilliant crimson
John Hopper.—Bright rose
Jules Margottin.—Bright-carmine
Lord Raglan.—Scarlet crimson
Madame Eugene Verdier.—Deep pink
,, Victor Verdier.—Bright cherry-red
Maharajah.—Deep crimson, single flowers
Margaret Dickson.—White, rose centre
Marie Baumann.—Bright carmine
Mrs. John Laing.—Soft-pink
Paule Neron.—Deep rose
Prince Camille de Rohan.—Deep velvety crimson-maroon
Senateur Vaisse.—Scarlet
Victor Hugo.—Bright crimson
Xavier Olibo.—Very dark-red, velvety

MR. N. C. ROLT, an experienced rose-grower in Ceylon, says: "The Hybrid Perpetuals are hardly worth growing now, so many splendid Hybrid Teas are on the market, these flowering almost all the year, which cannot be said of the former."

CLIMBING ROSES SUITABLE FOR TRAINING ON ARCHES, FENCES, PERGOLAS, PILLARS, ETC.

THOSE MARKED † ARE SUITED FOR THE LOW-COUNTRY.

† **Aimee Vibert.**—White
Ard's Rover.—Crimson, good bloomer
Blush Rambler.—Crimson
† **Celine Forestier.**—Rich sulphur-yellow
† **Devoniensis (Climbing).**—Creamy-white or carmine
Duchesse d'Anersloedt.—Yellow
Felicite Perpetue.—Creamy white
† **Gloire de Dijon.**—Orange-yellow, shaded salmon
† **Gruss an Teplitz.**—Bright crimson. Suitable as a pillar rose
Lamarque Jeaune.—Golden yellow
Lamarque White.—Blooms white
† **Marechal Niel.**—Beautiful deep yellow
† **Niphetos (Climbing).**—Pure white
Papa Gontier.—Rose pink, free grower
Papillon.—White with coppery shading, Splendid pillar Rose
Reine Marie Henriette.—Cherry red, first rate for the Hills
Noella Nabounand.—Crimson
Reve d'or.—Deep yellow
The Garland.—Blush white
† **William Allen Richardson.**—Orange-yellow

SHOWY ANNUALS AND BIENNIALS

CHIEFLY SUITED FOR UP-COUNTRY.

Name.	Natural Order.	Height in ft. (or inches.)	Colour of Flowers, etc.
Acroclinium roseum. "Everlasting" Flowers	*Compositae*	1½	Rose, pink, and white var's.
Ageratum mexicanum	,,	1—1½	Blue
Alonsoa Warscewiczii. Several var's.	*Scrophulariaceae*	1½—2	Orange-red, etc.

CLARKIA ELEGANS.

CANDYTUFT, "WHITE SPIRAL."

NIGELLA "MISS JEKYLL."

Name.	Natural Order.	Height in ft. (or inches).	Colour of Flowers, etc.
Alternanthera amœna. "Joy Weed." Several varieties	*Amarantaceae*	6—10 in.	Leaves bronze-green
Alyssum minimum. Sweet Alyssum	*Cruciferae*	6 in.	White, scented
Amaranthus caudatus. "Love-lies-bleeding."	*Amarantaceae*	1½—2	Bright-red, pendulous tails
A.—tricolor. Several varieties	,,	2 —3	Brilliant-red foliage
Ammobium alatum. "Winged Everlasting."	*Compositae*	1½—2	White
Anagallis grandiflora. Pimpernell	*Primulaceae*	8—10 in.	Blue, light-blue and white
Antirrhinum majus. Large and dwarf var's.	*Scrophulariaceae*	1	Shades of crimson

Acroclinium roseum

SCHIZANTHUS RETUSUS.

Name.	Natural Order.	Height in ft. (or inches).	Colour of Flowers, etc.
Arctotis grandis.	*Compositae*	1½—2	Bluish-white
Argemone grandiflora	*Papaveraceae*	2	White
A.—Hunnemannii	,,	2	Yellow
Asperula azurea. Woodruff	*Rubiaceae*	1	Light-blue, scented
Aster, China. Numerous varieties, as "German," "Victoria," "Mignon," "Crown," "Quilled," etc.	*Compositae*	6—15 in.	White, pink, lilac, etc.
Athanasia annua. "Everlasting."	,,	1	Yellow
Balsam (Impatiens). numerous varieties	*Gesneraceae*	8—12 in.	White, pink, rose-red, etc.
Bartonia aurea	*Gentianaceae*	1	Golden yellow, large fl's.
Brachycome iberidifolia. Swan River Daisy	*Compositae*	1	Blue and white var's.
Browallia grandiflora	*Solanaceae*	1—2	Dark blue, large fl's.
Cacalia (Emilia) coccinea	*Compositae*	1½—2	Scarlet ; erect stems
Calandrinia grandiflora Rock Purslane	*Portulaceae*	½	Pink, rose, yellow, etc.
Calceolaria hybrida. Slipper Wort	*Scrophulariaceae*	8—10 in.	Bright-yellow
Calendula officinalis. Pot Marigold Several varieties	*Compositae*	1—1½	Orange, yellow-striped, pale-lemon, etc.
C.—pluvialis. Cape Marigold	,,	1—1½	White and purple
Calliopsis, see *Coreopsis.*	—	—	—
Callichroa (Layia) platyglossa	*Compositae*	1	Yellow
Callirhoe digitata, "Poppy Mallow."	*Malvaceae*	1	Bright magenta.
Callistephus chinensis. See *Aster*	—	—	—
Candytuft, several varieties	*Cruciferae*	1—1½	White, crimson, etc.
Centaurea cyanus. Corn-flower	*Compositae*	1½	Rich-blue, lilac, pink, etc
C.—moschata. Sweet Sultan	,,	2	Purple.
Centranthus macrosiphon.	*Valerianaceae*	1½	Rosy purple
Chelone (Pentstemon) barbata	*Scrophulariaceae*	2½	Scarlet.
Chrysanthemum coronarium.	*Compositae*	1½	White yellow-eyed, etc.
C.—carinatum	,,	1½	Tricolor varieties.
C.—leucanthemum, "Ox-eye," or Shasta Daisy	,,	1½—2	Large, white, yellow eye.
C.—segatum. Yellow corn-flower	,,	1½	Yellow, several varieties.
Clarkia elegans.	*Onagraceae*	1½	Pale rose, pink, etc.
C.—pulchella.	,,	1½	Pale rose, pink, etc.
Clintonia (Downingia) elegans	*Campanulaceae*	1—1½	White, purple, etc.
C.—pulchella.	,,	,,	Blue
Collinsia bicolor.	*Scrophulariaceae*	1½	Purple and white
Convolvulus. See *Ornamental Climbers for Up-country*	—	—	—
Coreopsis (Calliopsis) bicolor	*Compositae*	1—2	Yellow and brown or crimson.

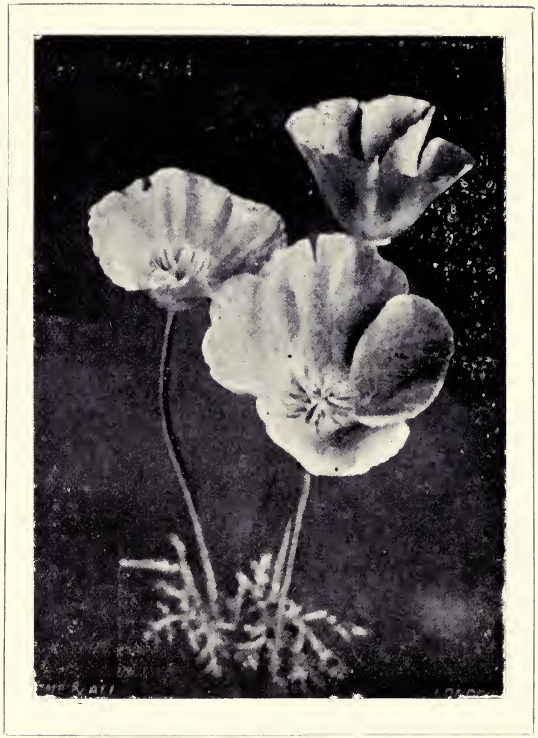
INDIAN PINK. *Dianthus Heddewigii.*

SWEET WILLIAM. *Dianthus barbatus.*

CLARKIA PULCHELLA.

Name.	Natural Order.	Height in ft. (or inches).	Colour of Flowers, etc.
C.—Drummondii	*Compositae*	1—2	Bright-yellow
Cosmos bipinnatus.	,,	2—3	Pink, white, etc.
C.—sulphureus.	,,	,,	Yellow.
Cuphea miniata.	*Lythraceae*	1—1½	Scarlet, tipped with yellow.
Datura Stramonium.	*Solanaceae*	2	White
Delphinium cardiopetalum. Larkspur. Numerous varieties	*Ranunculaceae*	1—2	Different shades of blue, purple, etc.
Dianthus barbatus. Sweet William	*Caryophyllaceae*	½—1	Pink and white

GAILLARDIA GRANDIFLORA.



ESCHCHOLTZIA.

Name.	Natural Order.	Height in ft. (or inches).	Colour of Flowers, etc.
D.—chinensis. Chinese or Indian Pink. Several single and double var's.	*Caryo-phyllaceae*	1	White, crimson, etc.
Erysimum Perowskianum.	*Cruciferae*	1	Orange and yellow
Eschscholtzia californica. Californian Poppy.	*Papavaraceae*	1—1½	Orange-yellow
Gaillardia picta. "Blanket flower."	*Compositae*	1—2	Yellow and crimson.
Gamolepis tagetes.	,,	9 in.	Bright-yellow, single fl's.
Gaura grandiflora.	*Onagraceae*	2	White
Gilia tricolor.	*Polemoniaceae*	8 in.	Large, lavender or white purple-eyed.
G.—multicaulis.	,,	1	Blue
Godetia Whitneyi. Numerous varieties.	*Onagraceae*	1	Rich-crimson, etc ; fl's large.
Gypsophila elegans.	*Caryophyllaceae*	1½	Feathery, lilac.
Helianthus annuus. Sunflower. Numerous tall and dwarf varieties.	*Compositae.*	1½—4	Yellow, dark-eye. Showy.
Helichrysum. Everlastings	,,	1½—2½	Yellow, white-orange, etc.
Ipomoea rubro-cœrulea "Morning Glory."	*Convolvulaceae*	8—16	Various shades ; large handsome fl's.
Ipomopsis (Gilia) elegans	*Polemoniaceae*	6—8	Tubular crimson fl's; feathery leaves.
Jacobaea elegans, see Senecio	—	—	—
Kaulfussia (Charieis) ameloides.	*Compositae*	1—1½	Blue, crimson and violet ; daisy-like fl's.
Larkspur, see Delphinium	—	—	—
Lathyrus. see Sweet Pea.	—	—	—
Layia, see Callichroa.	—	—	—
Leptosiphon (Gilia) roseus.	*Polemoniaceae*	8—10 in.	Rose-pink.
Leptogyne calliopsidea	*Compositae*	1½	Lemon-yellow, like Marguerites.
Linaria cymbalaria. Several var's.	*Scrophulariaceae*	6—12 in.	Lilac, yellow, orange, crimson, etc.
Linum grandiflorum rubrum. Several var's.	*Linae*	1½	Scarlet, blue, etc.
Lebelia erinus. Numerous var's.	*Campanulaceae*	½	Shades of blue, crimson, purple and white.
Lupinus polyphyllus. Lupin. Several var's.	*Leguminosae*	½—2	Orange, yellow, blue, etc.
Malope grandiflora	*Malvaceae*	1½—2	Crimson, white-striped, etc.
Marigold, African. Tagetes erecta.	*Compositae*	,,	Lemon-yellow, orange, etc.
M.—French. Tagetes patula. "Samie-poo" *T.*	,,	½—1	Orange-yellow, and crimson var's.
Malcolmia maritima. See *Virginian Stock*	—	—	—
Matthiola annua, see *Stocks*	—	—	—
Mesembryanthemum tricolor. Fig Marigold	*Ficoideae*	½—1	Different shades pink, etc.
Mignonette (Reseda odorata) Numerous varieties	*Resedaceae*	1—1½	Greenish-white or yellow, very fragrant.

T=Tamil

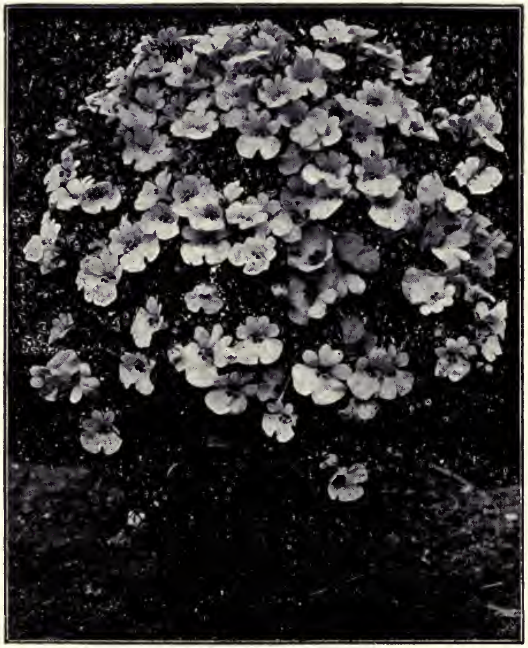
AFRICAN MARIGOLD.

PHLOX DRUMMONDII.

ARCTOTIS GRANDIS.

Name.	Natural Order.	Height in ft (or inches).	Colour of Flowers, etc.
Mimulus maculosus. "Monkey Flower"	*Scrophulariaceae*	8—10 in.	Pale-yellow, blotched, etc.
Mirabilis Jalapa. "Marvel-of-Peru"	*Nyctaginae*	1—1½	Rose-pink, white, etc.
Myosotis. Forget-me-not	*Boraginaceae*	8—10 in.	Blue; several varieties.
,, "Royal Blue" and other var's	,,	,,	Blue, very effective.
Nasturtium (see *Ornamental Climbers*	—	—	—
Nemesia strumosa.	*Scrophulariaceae*	12—15 in.	White, crimson, yellow, etc.
Nemophila insignis.	*Hydrophyllaceae*	½	Blue, white, and purple-margined.

SWEET SULTAN.



NEMESIA, "SUTTON'S HYBRID."

Name.	Natural Order.	Height in ft. (or inches.)	Colour of Flowers, etc.
Nicotiana affinis. Tobacco Plant Numerous species and var's.	*Solanaceae*	2—3	White, purple, pink, etc.
Nierembergia frutescens.	,,	1	Blue.
Nigella damascena. Fennel flower.	*Ranunculaceae*	12—15 in.	Fl's pale-blue; feathery foliage.
Nolana grandiflora.	*Nolanaceae*	8—10 in.	White and blue; trailing.
Nycterinia selaginoides.	*Scrophulariaceae*	6—8 in.	Pink
Oenothera biennis. "Evening Primrose."	*Onagraceae*	1— ½	Large, bright-yellow fl's.
Pansy, numerous varieties.	*Violaceae*	½	Numerous shades.
Papaver, see *Poppy*.	—	—	—
Pentstemon, numerous spp. and var's.	*Scrophulariaceae*	1—1½	Crimson, rosy-purple, etc.
Petunia, single and double var's.	*Solanaceae*	,,	White, purple, and striped; large showy fl's.
Phacelia campanularia.	*Hydrophyllaceae*	,,	Bright-blue; several var's.
Platystemon californicus. "Californian Poppy."	*Papaveraceae*	1	Bright lemon-yellow.
Philydrum lanuginosum.	*Philydraceae*	3	Yellow.
Phlox Drummondii. Numerous showy var's.	*Polemoniaceae*	1	White, red, purple, crimson margined and fringed var's.
Poppy, Shirley. (*Papaver Rhoeas*)	*Papaveraceae*	1—2	Scarlet, purple, white, etc.
Poppy, opium. (*P. Somniferum*)	,,	,,	Different shades, single and double var's.
Poppy, Californian, see *Platystemon*	,,	1	Bright lemon yellow.
Portulaca grandiflora. "Sun Plant."	*Portulacaceae*	½	Brilliant different hues.
Pyrethrum aureum. Golden Feather	*Compositae*	6—8 in.	Handsome yellow foliage
Reseda, see *Mignonette*.	—	—	—
Rhodanthe Manglesii. "Everlasting."	*Compositae*	1—1½	Rosy-purple, etc.
Salpiglossis coccinea. Numerous varieties	*Solanaceae*	1½—2	Scarlet, blue, purple, etc.
Saponaria calabrica. Soap-wort	*Caryophyllaceae*	1	Bright-pink.
Scabiosa. Several varieties	*Dipsaceae*	1½—3	Blue, yellow, etc.
Schizanthus pinnatus. "Fringe Flower"	*Scrophulariaceae*	1½—2	Purple, crimson, etc.
Sedum. Stonecrop. Numerous varieties	*Crassulaceae*	½	Yellow, white, purple, etc.
Senecio elegans. Purple Jacobæa	*Compositae*	1½	Crimson, purple, white, etc.
Silene pendula. "Catch Fly"	*Caryophyllaceae*	1½	Carmine; single and double varieties.
Spartium junceum. "Spanish Broom."	*Leguminosae*	2—3	Handsome yellow fl's.
Sphenogyne speciosa. Several varieties	*Compositae*	1	Yellow, crimson, white, etc.

SWEET PEA, "MARJORIE WILLIS."

SWEET PEA, "KING EDWARD."

Name	Natural Order.	Height in ft. (or inches.)	Colour of Flowers, etc
Statice sinuata. Sea Lavender. Several varieties	*Plumbagineae*	1—1½	Golden-yellow, rose-purple, etc.
Stocks, "Ten weeks," "East Lothian," and "Virginian."	*Cruciferae*	1—2	White, purple, etc.
Sunflower. See *Helianthus*	—	—	—
Sweet Pea. (*Lathyrus odoratus*)	*Leguminosae*	4—5	Numerous beautiful shades
Sweet William. See *Dianthus barbatus*	*Caryophyllaceae*	8—10 in.	Variegated scarlet, crimson, etc.
Tobacco Plant, see *Nicotiana*	—	—	—
Torenia Fourneri.	*Scrophulariaceae*	½—1	Pale-blue; also a white variety.
T.—Bailloni.	"	"	Yellow, trailing
Trachelium coeruleum.	*Campanulaceae*	1—1½	Blue
Trachymene coerulea.	*Umbelliferae*	1½	Blue
Tropaeolum majus. "Nasturtium."	*Geraniaceae*	1	Shades of crimson, etc.
Verbena. Numerous varieties	*Verbenaceae*	1	White, scarlet, purple, etc.
Viola, see *Pansy*	—	—	—
Violet (*Viola odorata*). Several single and double var's. See page 439	*Violaceae*	½	Blue, purple, white, etc.
Whitlavia (Phacelia) grandiflora	*Hydrophyllaceae*	3 5	Violet-purple
Xeranthemum annuum. "Everlasting"	*Compositae*	1—1½	Rose, white, violet, etc.
Zinnia. Numerous varieties	"	1½	Scarlet, pink, yellow, etc.
Z. Haageana.	"	1	Orange-yellow, single.

ORNAMENTAL BULBOUS OR TUBEROUS PLANTS

Chiefly Suited for Borders, Etc., Up-country,

Propagated by bulbs, tubers, or division, and in some cases also by seed.

Name.	Natural Order.	Colour of Flowers.	Height in ft. (or inches.)
Agapanthus umbellatus. "African Lily"	*Liliaceae*	Blue	2—2½
A.—umbellatus, var. alba	"	White	"
Albuca aurea. S. Africa	"	Greenish-yellow	2
Allium fragrans. Numerous other species	"	White	1
Alstromeria multiflorus	*Amaryllideae*	Orange-yellow	2—3
A.—psittacina	"	Crimson	1½—2

ASTER, "DWARF FRENCH INCURVED."

GODETIA, "FAIRY QUEEN."

Name.	Natural Order.	Colour of Flowers.	Height in ft. (or inches.)
Amaryllis Belladona. Belladona Lily	*Amaryllideae*	Bright-pink	1
Anthericum Liliastrum. St. Bruno's Lily	,,	White	1
Antholyza bicolor.	,,	Scarlet and green	2
Aristœa eckloni. S. Africa	*Irideae*	Bright blue	1½—2. Nat. in Ceylon
Arthropodium cirrhatum	*Liliaceae*	White	2
Arum Lily, see *Richardia*	—	—	—
Begonia, tuberous-rooted. Numerous varieties	*Begoniaceae*	Scarlet, yellow, etc.	1—1½
Belamcanda chinensis. "Leopard Lily"	*Irideae*	Orange-red, spotted brown	1½
Clivia, see *Imantophyllum*	—	—	---
Crinum asiaticum.	*Amaryllideae*	White	2—3
C.—giganteum	,,	,,	,,
C,—Mooreii	,,	Rose	1
Cyrtanthus carneus	,,	Bright-red	1
C.—intermedius	,,	Pink	1
C.—Mackenii. "African Bride"	,,	White	1
Dahlia, "Cactus," "Pompon;" etc. Double and Single var's	*Compositae*	Various	2½—3
Freesia refracta	*Irideae*	Creamy white	1½—2. Scented
Gladiolus, several varieties	,,	Different shades	2—3
Gloxinia, see *Pot Plants*	—	—	—
Hemerocallis aurantiaca "Golden Lily"	*Liliaceae*	Bright-yellow	2½
H.—fulva. "Day Lily"	,,	Orange-yellow	1—1½
Hippeastrum. "Knight's Star-Lily." Numerous varieties.	*Amaryllideae*	Red, white-streaked, etc.	1½
Imantophyllum miniata	,,	Scarlet	1—1½
Iris, different varieties.	*Irideae*	Yellow, purple, blue, etc.	,,
Ismene calanthina. "Peruvian Daffodil"	*Amaryllideae*	White	1—2, fragrant.
Isoloma bogotense	*Gesneraceae*	Yellow and red	1½
I.—Molle.	,,	Scarlet and yellow	1½
Ixia flexuosa	*Irideae*	Pink	2
I.—pendula	,,	Yellow	2
Lachenalia aurea.	*Liliaceae*	Orange yellow	8—10 in.
Leucojum æstivum. "Snow Flake"	*Amaryllideae*	White	
Libertia formosa.	*Irideae*	,,	1½
L.—paniculata	,,	,,	1½
Lilium longiflorum.	*Liliaceae*	,,	3—4
L.—Harrissii. "Easter," or Bermuda Lily.			
L.—auratum. "Golden-rayed Lily."	,,	White, purple, yellow	3—4
L.—candidum. "Madonna Lily."	,,	White	2—3

LILIUM CANDIDUM. MADONNA LILY

LILIUM LONGIFLORUM.

Name.	Natural Order.	Colour of Flowers.	Height in ft. (or inches.)
L.—Martagon. "Turk's Cap Lily."	*Liliaceae*	Purple and white	3—4
L.—nepalense	,,	Dark purple	1½—2½
L.—tigrinum. "Tiger Lily."	,,	Orange	2
Lycoris aurea.	*Amaryllideae*	Yellow	1
L.—sanguinea	,,	Carmine	1½
Marica cœrulea.	*Irideae*	Blue	2
Montbretia, see Tritonia	—	—	—
Moræa iridioides.	,,	,,	2
Nerine japonica (=*Lycoris radiata*)	*Amaryllideae*	Red	1
N.—sarniensis. "Guernsey Lily."	,,		1
Ornithogalum nutans. "Star of Bethlehem."	*Lilliaceae*	White, etc.	1
Pardanthus *Balamcanda*	—	—	1—1½
Phædranassa chloracea	*Amaryllideae*	Crimson	1
Richardia (Calla) æthiopica. Arum Lily.	*Aroideae*	White	2
R.—Elliotiana	,,	Yellow	2
Sparaxis grandiflora.	*Irideae*	Purple, white, etc.	2
Sparaxis tricolor	,,	Orange and yellow	2 Large fl's
Sprekelia formosissima. "Jacobæa Lily"	*Amaryllideae*	Deep-crimson	1
Tigrida pavonia. "Tiger Lily"	*Irideae*	Orange-red	1½—2½
Tritonia (Montbretia) aurea. "Torch Lily"	,,	Orange	1½—2½
Vallota purpurea. "Scarborough Lily"	*Amaryllideae*	Red, crimson, white	1—1½
Watsonia augusta	*Irideae*	Scarlet	2—3
W.—densiflora	,,	Bright-crimson	2½—3½
Zephyranthes candida. Zephyr Lily	*Amaryllideae*	White	1
Z.—Carinata. Rose Amaryllis	,,	Bright Rose	1
Z—tubispatha	,,	White	10 in.

SELECTED PLANTS SUITABLE FOR GROWING IN POTS UP-COUNTRY

Many of the foregoing selections of annuals, biennials, bulbous and tuberous plants, etc., are well-adapted for pot-culture at medium to high elevations, and in addition to these the following may be mentioned as especially suited for the purpose with however, the protection of a green-house or a glazed verandah, palms and many other choice plants of lower elevations (which without such artificial protection would not thrive much above 3,000 ft.) can be grown in the hills with much success. The limit of elevation in Ceylon, under ordinary conditions, for purely tropical palms may be

GERMAN IRIS.

SILENE PENDULA.

said to be about 3,000 ft. Palms which are indigenous to sub-tropical regions or high elevations will, however, flourish best at the higher altitudes, and are unsuited to low elevations. For a list of these see under *Palms*.

Achimenes.—Small tuberous-rooted herbaceous plants Flowers numerous and showy.

SHASTA DAISY. *Chrysanthemum leucanthemum.*

Aspidistra lurida variegata.—Hardy stemless plant, with large handsome green and white-striped leaves.

Azalea indica.—Small shrubs, bearing a profusion of large showy pink, white, or yellow flowers. Numerous varieties.

Begonia, fibrous-rooted.—Numerous varieties, showy flowers and foliage.

B.—tuberous-rooted.—Very large, brilliant yellow or scarlet flowers.

B.—rex.—About 10 to 12 inches high. Foliage large, very ornamental. Numerous varieties.

Calathea.—A herbaceous stemless genus, with large showy leaves. Propagated by division.

DIELYTRA SPECTABILIS. "LYRE FLOWER."

SPIRAEA (HOTEIA) JAPONICA.

Chrysanthemum, Japanese.—One of the most beautiful genera of flowering plants. Numerous varieties.

Cineraria.—A genus of showy flowering plants, bearing large heads of blue or purplish flowers ; cultivated as annuals.

Coleus.—Annuals with beautifully marked, soft velvety leaves, easily propagated by cuttings.

CINERARIA STELLATA.

Clyclamen.—Small tuberous plants, bearing very pretty delicate pink, crimson, or white flowers ; suited only for growing under cover at the higher elevations.

Dracaena (Cordyline).—Handsome palm-like plants, with bronze, crimson, or green leaves. Numerous varieties. Propagated by suckers or portions of the stem.

Epiphyllum.—Succulent plants, bearing very showy, bright pink or crimson flowers.

IXIA PENDULA.

BEGONIA REX. BEAUTIFULLY VARIEGATED SATINY FOLIAGE.

Ferns.—See article on *Ferns*.

Francoa ramosa.—An ornamental creeping plant, suitable for hanging pots; Propagated by division or cuttings.

Freesia.—A Cape genus of small tuberous plants producing a profusion of creamy-white, scented flowers. There are several species and varieties.

BROWALLIA SPECIOSA. FLOWERS BRIGHT BLUE.

They require a cool atmosphere and protection from the rains, and are best grown under cover.

Fuchsia.—A very ornamental gem of small flowering shrubs; numerous varieties. Propagated by cuttings.

Genista.—Small free-flowering shrubs, with yellow blossoms.

Geranium.—A universal favourite. Numerous varieties ; flowers of many shades, showy and scented. With care they thrive for a time at low and medium elevations, but require frequent pruning. They are much improved by a weekly application of a fertiliser, given in solution with water.

G.—,Zonal or Tri-color.—Leaves beautifully marked, horse-shoe shaped, fragrant.

GLOXINIA, "SUTTON'S GIANT."

G.—, Ivy-leaved.—Showy and free-flowering, suitable for training on pillars, trellises, etc.

Gesnera.—A genus of numerous species of small choice herbaceous plants, generally tuberous-rooted.

G.—Douglasii and G.—magnifica are especially attractive.

Gloxinia.—An extensive genus of tuberous-rooted small plants, exceedingly showy when in bloom.

Impatiens.—A showy genus of herbaceous flowering plants. Among the best are *I. Holstii*, *I. Sultani*, and *I. fasciculata*.

Pelargonium.—A class allied to Geraniums, with scented, curly or cut leaves and showy flowers. *Pelargonium* is the botanical name for Geranium.

Petunia.—A very showy genus of flowering annuals, blooming freely and continuously. Single, double, and fringed varieties.

Primula chinensis.—Small annual flowering plants, of which there are numerous varieties.

P.—obconica.—Small perennial plants, flowering in the winter season.

Spiroea (Hoteia) japonica.—A popular plant for pot-culture; flowers creamy white, in large panicles.

Streptocarpus.—A perennial herb with prostrate leaves, bearing scapes of large bluish or lilac flowers. Several species and hybrids.

Violets. (*Viola odorata*).—Several single and double-flowered varieties; can be grown successfully in sheltered borders or in pots. Among the best are: *Neapolitan* (double fl's;) pale lavender, very sweet-scented; *Czar* (large, single, blue fl's); *Compte Brazza* (large double, white fl's).

CHAPTER XIX.

PLANTS SPECIALLY SUITED FOR THE DRY REGION, SEA COAST, AND SANDY SITUATIONS.

ORNAMENTAL AND USEFUL TREES FOR THE DRY REGION :—

[*S.*=Sinhalese ; *T.*=Tamil].

Acacia leucophlœa. "Maha-andara" *S.*, "Velvel" *T.* A large tree with spreading branches, and bright pale-yellow flowers. Heart-wood hard and durable.

Adansonia digitata. Baobab Tree. A medium-sized tree, native of Central Africa, famous for the great age and enormous size of trunk to which it attains. It has become well established and bears fruit in the dry Northern part of Ceylon, where it has been long ago introduced by Arab traders.

Adenanthera pavonina. Bead Tree ; "Madatiya" *S.* See under *Shade Trees.*

Azadirachta indica. Margosa. "Kohomba" *S.* A tall straight tree with long spreading branches. Flowers white, sweet-scented.

Bauhinia tomentosa. "Petan" or "Kaha-petan" *S.*, "Tiruvatti" *T.* A. small tree or large shrub, with slender branches and yellow flowers. Heart-wood hard, dark-red, very tough.

Berrya ammonilla. "Hal-milla" *S.*, Chavandalai" *T.* A large erect handsome tree; valuable timber. See *Important Timbers of the Tropics.*

Caesalpinia coriaria. Divi-divi. A spreading, medium-sized tree, with fine feathery leaves, producing greenish-white, sweet-scented flowers. See *Tannin Products.*

Cassia Fistula. "Indian Laburnum," "Ehela," *S.*
C.—marginata. "Ratu-wa" *S.*, "Vakai" *T.*
C.—multijuga. (South American Tree.)
} See *Beautiful Flowering Trees* for low elevations.

Eucalyptus alba. A tall slim tree with pale grey bark ; one of the few species of Eucalypti suited to the dry region.

Holoptelea integrifolia. "Indian Elm," "Goda-kirilla" *S.*, "Velayil" *T.* A tree 50 to 60 ft. high, with handsome drooping branches ; good timber.

Millingtonia hortensis. Cork Tree. See *Beautiful Flowering Trees* for low elevations.

Mischodon zeylanicus. "Tammana," *S.*, Tampani" *T.* A tree 30 to 40 ft. high, with long lanceolate leaves; young foliage bright pink. Excellent timber.

Murraya exotica, var buxifolia. "Etteriya" *S.* A small graceful tree; flowers pure white and sweet-scented.

Persea (Alseodaphne) semecarpifolia. "Wewarani" *S.*, "Ranai," or "Vavaranai" *T.* A large much-branched tree, common to the dry region. One of Ceylon's best timbers.

Pithecolobium (Inga) Saman. Rain tree; "Peni-karal" *S.* See under *Shade Trees.* Thrives in a fairly dry district if planted in good deep soil.

Poinciana regia. Flamboyante. See under *Flowering Trees for low elevations.*

Polyalthia longifolia. "Mara-illupai" *T.* A large handsome erect tree, much planted as an avenue tree in North Ceylon and S. India.

Spathodea campanulata. See *Beautiful Flowering Trees.*

Tamarindus indicus. Tamarind; "Siyambala" *S.* A large handsome tree adapted for roadsides. Excellent timber.

Thespesis populnea. Tulip Tree; "Suriya" *S.*. See under *Shade Trees*

Vitex altissima. "Milla" or Sapu-milla" *S*, "Kadamanakku" *T.* A very large tree, with a dense head and somewhat drooping branches.

V.—Leucoxylon. "Nebedda," *S.* "Kaddu-nochchi" *T.* A large tree with spreading head, common in dry region, especially near tanks. Wood hard, dark-grey, valuable timber.

SHADE TREES.—See Chapter on *Shade Trees.*

FLOWERING SHRUBS.

Allamanda Schottii. Flowers yellow
Barleria cristata. Pink and white
Caesalpinia pulcherrima. "Peacock flower." Bright yellow or scarlet
Gardenia florida. Fl's white, scented
Ixora coccinea "Ratambala" *S.* Flowers scarlet
Ixora rosea. Flowers pink
Jasminum pubescens. Fl's white, scented
Lagerstroemia indica. Bright purple fl's
Pavetta inchica. Fl's white
Randia dumetorum. "Kukuruman" *S.* Fl's white
Reinwardtia tetragyna Yellow fl's.
Thunbergia erecta. Blue or white fl's
Turnera ulmifolia. Fl's white

ORNAMENTAL CLIMBERS:—

Allamanda Hendersonii. Fl's large white
Antigonon leptopus. Fl's lovely pink.
Bignonia unguis. Fl's yellow
Bougainvillea spectabilis. Bright purplish-crimson
Ipomœa Briggsii. Fl's bright-crimson
Ipomœa tuberosa. Fl's yellow
Porana volubilis. "Bridal Bouquet" Fl's creamy-white
Quisqualis indica. "Rangoon Creeper"- Fl's orange-red
Thunbergia laurifolia =T. grandiflora } Fl's. large blue

FOR THE SEA-COAST.

ORNAMENTAL TREES:—

[S=Seed; C=cuttings; Su=suckers.]

Name.	Natural Order.	How Propagated.	Height and descriptive notes.
Artocarpus incisa. Bread-fruit	*Urticaceae*	Su.	40—50 ft. A beautiful foliage tree.
Barringtonia speciosa Mudilla" *S.*	*Myrtaceae*	S	About 50 ft.; handsome large leaves.

S=Sinhalese; *T*=Tamil.

Name.	Natural Order.	How Propagated.	Height and descriptive notes.
Carallia integerrima. "Dewata" S.	*Rhizophoraceae*	S	50—60 ft.
Casuarina equisitifolia. Beef-tree: "Kassa" S.	*Casuarinae*	,,	50—80 ft. Ornamental.
Cerbera borbonica. "Mudu-kaduru" S.	*Apocynaceae*	,,	About 25 ft. Fl's white.
Cocos nucifera. Coconut Palm	*Palmae*	,,	60—80 ft.
Eucalyptus alba. ! White Gum-tree	*Myrtaceae*	,,	50—60 ft. Smooth, white bark.
E.—citriodra. Lemon-scented Gum-tree	,,	,,	40—50 ft. Slender handsome tree.
Gliricidia maculata. "Madre"	*Leguminosae*	S or C	About 30 ft. See *Beautiful Flowering Tree.*
Morinda citrifolia. "Ahu" S.	*Rubiaceae*	S	25—30 ft. Large leaves
Ochrosia borbonica. "Mudu-kaduru." S.	*Apocynaceae*	,,	30 ft. Large handsome leaves.
Peltophorum ferrugineum. "Iva-vakai" T.	*Leguminosae*	,,	See *Beautiful Flowering Trees.*
Pisonia morindifolia. Lettuce Tree; "Letchicotta" T.	*Nyctagineae*	C	See *Ornamental Foliage Trees.*
Pithecolombium dulce. "Madras Thorn"	*Leguminosae*	S	40—50 ft. high; also coppiced and used as hedges.
P.—Saman. Rain Tree; "Peni-karal" S.	,,	,,	See *Shade Trees for Roadsides.*
Plumeria acutifolia. Temple-Tree	*Apocynaceae*	C	See *Beautiful Flowering Trees.*
P.—rubra. Crimson, Temple-Tree	,,	C or S	See *Beautiful Flowering Trees.*
Poinciana regia. Flamboyante	*Leguminosae*	S	See *Beautiful Flowering Trees.*
Polyalthia longifolia. "Mara-illupai" T.	*Anonaceae*	,,	See *Ornamental Foliage Trees.*
Pterocarpus indicus. Padouk	*Leguminosae*	,,	See *Ornamental Foliage Trees.*
Spathodea campanulata.	*Bignoniaceae*	,,	See *Beautiful Flowering Trees.*
Thespesia populnea. Tulip Tree; "Suriya" S.	*Malvaceae*	,,	See *Shade Trees for Roadsides.*

ORNAMENTAL SHRUBS :—

[S.=seeds; C.=cuttings; Su.=suckers].

Name.	Natural Order.	How Propagated.	Height and descriptive notes.
Acalypha, different var's	*Euphorbiaceae*	C	8—10 ft. Large bright-coloured leaves.
Agave americana variegata. American Aloe	*Amaryllideae*	Su. or S	6—8 ft. Leaves variegated, very striking.
Aralia filicifolia.	*Araliaceae*	C	6—8 ft. Young leaves yellow, very handsome.
Arundo Donax variegata.	*Gramineae*	Div. or C	6—8 ft. Handsome variegated grass.

S.=Sinhalese. *T.*=Tamil.

Name.	Natural Order.	How Propagated.	Descriptive notes.
Cæsalpinia pulcherrima. "Peacock Flower"	*Leguminosae*	S	5—6 ft. Fl's bright yellow.
Carissa Carandas. "Maha-karamba" *S.*; "Perunkila" *T.*	*Apocynaceae*	..	A spiny shrub with white fl's. See *Tropical Fruits.*
Clerodendron inerme. "Wal-gurenda" *S.*; "Pinari" *T.*	*Verbenaceae*	S or C	3—5 ft. Fl's white, tinged with pink.
C.—nutans.	..	C	4—5 ft. Fl's white, pendulous.
C.—Siphonanthus.	..	S or C	5—6 ft. Showy.
Croton (Codiœum), different var's	*Euphorbiaceae*	C	5—8 ft. Very showy, brightly coloured foliage.
Datura suaveolens. "Trumpet-flower"	*Solanaceae*	,,	6—8 ft. Fl's large, white.
Hibiscus (Shoe-flower), numerous var's	*Malvaceae*	,,	6—8 ft. Fl's of various shades, pink to scarlet yellow and white.
Ixora, different species and var's	*Rubiaceae*	,,	4—6 ft. Fl's various colours pink, yellow, and scarlet.
Lagerstrœmia indica. "Crape Myrtle"	*Lythraceae*	,,	6—8 ft. Fl's purple-lilac, in large racemes.
Nerium Oleander. Oleander	*Apocynaceae*	,,	8—12 ft. or more. Fl's large, bright crimson or pink.
Panax fruticosum.	*Araliaceae*	,,	5—6 ft. Leaves much cut, ornamental.
Pandanus odoratissimus. Screw-pine; "Mudu-keyiya" *S.*; "Talai" *T.*	*Pandanaceae*	Su. or S	15—20 ft. high. Fruit globose or oblong, scarlet.
Pavetta indica. "Pawatta" *S.*; "Pavaddai" *T.*	*Rubiaceae*	C or S	4—6 ft., bears a profusion of white flowers.
Scœvola. Kœnigii. "Takkada" *T.*	*Goodenoviaceae*	,,	A large bush, 6—10 ft., fl's white.
Sophora tomentosa. "Mudu-murunga" *S.*	*Leguminosae*	,,	4—6 ft. covered with grey velvety pubescence.
Vinca rosea. Madagascar Periwinkle	*Apocynaceae*	,,	2 ft. Fl's rose-pink or white.
Wrightia zeylanica. "Wal-idda" *S.*	..	,,	3—5 ft. Slender, erect branches; fl's pure white.
Yucca gloriosa. "Spanish Bayonet"	*Liliaceae*	S or Su.	5—8 ft. Leaves stiff, sharp-pointed: fl's white, in large erect panicle.

Ornamental Climbers :—

[S.=Seed ; C.=Cuttings ; Su.=Suckers].

Name.	Natural Order.	How Propagated.	Descriptive notes.
Allamanda Hendersonii	*Apocynaceae*	C	A quick-growing climber, with large, yellow bell-shaped fl's.
Antigonon guatamalensis	*Polygonaceae*	C or S	A moderate-sized climber with lovely pink fl's.

S.=Sinhalese ; *T.*=Tamil.

Name.	Natural Order.	How Propagated.	Descriptive notes.
Argyreia speciosa "Maha-dumudu" S.	*Convolvulaceae*	C or S	Leaves large handsome, greyish-white beneath fl's large, purple.
Bignonia unguis	*Bignoniaceae*	S or Su.	A slender creeper, yellow fl's, very beautiful.
Clerodendron Thomsonæ	*Verbenaceae*	C or S	Fl's white and scarlet.
Cryptostegia grandiflora	*Asclepiadeae*	C	Fl's bright pink.
Ipomœa Briggsii	*Convolvulaceae*	,,	Bright crimson, very showy, free bloomer.
I.—carneum	,,	,,	Fl's pale-pink.
I.—vitifolia	,,	S or Su.	Fl's bright yellow.
Quisqualis indica "Rangoon Creeper"	*Combretaceae*	C	Fl's orange-red, sweet-scented.
Porana volubilis "Bridal Bouquet."	*Convolvulaceae*	,,	A large climber; fl's creamy-white, in large panicles.
Tristillateia australas. Australia	*Malpighiaceae*	,,	Fl's in yellow racemes; free bloomer.

SAND-BINDING PLANTS

Certain plants have a natural capacity for growing in loose sandy soils, or even in pure sand, as on barren sea-shores or river banks. The value of such plants does not consist only in their sand-binding properties, by which they prevent the erosion of land or the shifting of sand-banks, etc., but also in establishing a foundation in which it may be possible to introduce and grow more useful plants. For sand-banks by the sea-shore, the following plants are among the most adaptable :—

Calotropis gigantea; "Wara" *S.* A large glaucous shrub, with large oblong leaves; common near sea coast in Ceylon.

Canavalia obtusifolia. "Mudu-awara" *S.* A creeping leguminous perennial, with bright-pink (sometimes white) flowers. Grows on the sandy sea-shores.

Spinifex squarrosus. "Water Pink," "Maharawana-rewula" *S.* A grey or glaucous grass which grows in broad tufts on the sandy sea-shores. It is especially cultivated on the Madras coast for its sand-binding properties.

Ipomoea biloba.—"Mudu Bin-tamburu" *S.* A creeping plant of the Convolvulus family, with bright purplish-rose flowers and thick succulent leaves; common on the sea-shore sand along the south and west coast of Ceylon.

Scaevola Koenigii. A large glaucous bush, with yellowish white flowers and pithy stems; common on the south-west coast of Ceylon.

Pandanus odoratissima. Screw Pine; "Mudu-keiya" *S.* A spreading bush with numerous aerial roots, which descend and fix the plant in the sand.

Barringtonia racemosa. "Medilla" *S.* A small tree with drooping branches, common near the sea-shore in Ceylon.

Tephrosia purpurea. "Pila" *S.* A perennial, 1 to 2 feet high; flowers small, purplish-pink.

Cassia auriculata. "Ranawara" *S.* An annual, 1 to 2 feet high, with spreading branches and bright-yellow flowers. The dried leaves form the "Matara Tea" of Ceylon.

FOR INLAND SANDY BANKS

Certain useful sand or bank-binding plants also afford valuable fodder or grazing for cattle. Thus in the low-country, the "Mauritius-grass" (*Panicum muticum*), "Guinea grass" (*P. maximum*), and "Etora" (*P. repens*) are excellent subjects for combining the purposes of fodder and soil-binding on the banks of rivers or streams; while in drier situations the Doob-grass or "Arugam-pillu" *T* (*Cynodon Dactylon*), Love-grass or "*Tutteri*" *S.* (*Chrysopogon aciculatus*), "Hin-undu-piyali" *S.* (*Desmodium triflorum*), *Cassia mimosifolia*, and the Sensitive-plant (*Mimosa pudica*), all have useful binding properties on loose sandy soils. At elevations of 4,000 to 6,000 feet, *Paspalum dilatatum* ("Golden-Crown" grass) is an excellent plant for binding railway banks, etc., while it is also one of the best fodder plants for up-country.

CHAPTER XX.

SHADE TREES

For Different Purposes and Elevations

The importance of shade trees in the tropics is impossible to over-estimate; they are essential to the planter for his crops, and are a boon to man and beast on account of the shelter they afford from the sun, as well as for their effect in tempering the atmosphere. Most crops in the tropics require shade at some stage of their growth, some more or less permanently, especially at low elevations, where also bungalows or other human abodes are improved in comfort by a certain amount of protection from the powerful rays of the tropical sun. Shade trees enhance the beauty of our surroundings, and render the atmosphere cooler and healthier by checking radiation from the soil. In towns as well as in malarial districts, the hygienic effects of suitable and well-grown trees are well known. It is a mistake, however, to plant trees or shrubs, especially such as have adaptations for collecting water, as sheathing leaf-bases or spathulated inflorescence, too near houses, for they harbour mosquitoes and thereby encourage malaria. Certain trees, as Spathodea, may also be a source of danger from their liability to be blown down by wind, while others (as species of Ficus) are objectionable on account of their extensive root system. Others again, as Casuarina, frequently block gutterings, drains, etc., by the almost constant dropping of leaves.

Qualities of Good Shade Trees.—The suitability of trees for purposes of shade depends much on local conditions and individual requirements. Some trees may also serve other useful purposes in addition to providing shade or shelter; thus, certain kinds which yield edible fruit or other useful product may in some localities be also used to combine shade. In parts of India, Mangoes and other fruit-trees are employed for this dual purpose; while in some European countries the leasing of fruit-trees which have been planted along public roads is a valuable source of revenue to their respective governments. The most essential qualities of a good

shade-tree are: (1) it should be ever-green, or at least have the habit of putting on fresh foliage immediately after shedding the

PITHECOLOBIUM (INGA) SAMAN. "RAIN TREE" OR GUANGO.
An excellent road-side shade tree when properly planted and attended to.

old leaves; (2) it should have a normally spreading form, with an upright clean trunk for at least 15 ft. from the ground; (3) it should be a fairly fast grower; and (4) the foliage should be of a

light feathery nature, with small leaves which have the habit of closing at night or in dull weather. Too rapid a growth must be deprecated as being productive of brittle wood and short-lived trees. Shade trees may be said to belong to either of two types in regard to habit of growth, viz: (1) *centripetal* (towards the centre), in which the branches are developed in an upward or horizontal direction; and (2) *centrifugal* (from the centre), with the branching system curving downwards or drooping. Trees of the former type

PITHECOLOBIUM (INGA) SAMAN AS A SHADE TREE, SHOWING EFFECTS OF ILL TREATMENT.

are the most suitable for road-sides or streets, while those of the latter are very effective when planted in parks, pastures or open spaces. The quality of any shade tree may be said to depend largely upon the attention given it when young, as well as on the manner of planting. Careless or improper planting, injury by cattle, etc., when young, or ruthless treatment by disinterested owners of adjoining land, will permanently disfigure shade-trees however good their qualities may be.

Trees for Parks, Pasture Land, etc.—Scenic effects should here be studied in combination with the practical purposes of shade-trees. Those of bold appearance, with striking foliage and drooping branches, will produce an imposing effect and, at the same time, improve the conditions of pasture, their shade encouraging the growth of soft, tender herbage.

Shade Trees for Field Crops.—That suitable shade-trees, thinly planted and properly attended to, have beneficial effects, physically or chemically, upon most crops in the tropics is an established fact. They help to conserve moisture, aerate the soil

SHADY RIVER-DRIVE IN PERADENIYA GARDENS.

by means of their deep-feeding roots, which bring plant-food from the under-strata to be returned again in the form of mulch by the fallen leaves. Leguminous trees are preferable for various reasons, viz:—(1) They are usually fast-growers, (2) their thin feathery foliage does not form too dense a shade, (3) their leaves have often the habit of closing up at night, and (4) many of the family have the property of collecting free nitrogen by means of bacteria nodules on their rootlets.

Trees for Road-sides, Streets, etc.—Trees of the type with upright or horizontally spreading branches should be chosen for

this purpose. Large leaves and heavy dangerous fruits are obviously characters which disqualify for planting in public thoroughfares. The ideal tree for this should have, in addition to being evergreen and of an upright spreading habit, light thin foliage, with the leaves closing up at night or in dull cloudy weather. Probably the Inga Saman or Rain Tree approaches most closely these requirements. It is a handsome tree when well-grown, being adapted to a fairly wide range of climate, and incidentally its nutritious sugary pods form an excellent cattle-food. The planting and preservation of suitable shade trees for road-sides being of great importance to the public, the writer would suggest the adoption of certain recognised rules, such as the following, for their proper planting and maintenance :—

(a) Proper holes (from 2 to 3 ft. deep, by as much in diameter, and ¾ filled with good soil) to be prepared before planting.
(b) Where possible, holes to be well behind the side-drains and not in the margin of the road; the distance from the road should be from 8 to 10 feet, according to circumstances.
(c) The plants to be well-established in bamboo-pots or plant-baskets before being planted out.
(d) Planting out should, as far as possible, be done at the commencement, not at the end, of the rainy seasons.
(e) The distances for planting apart in the first place may be from 25 to 30 feet (according to species of tree), every alternate tree being cut out later, if necessary, as it fills its allotted space or encroaches on its neighbour.
(f) Proper protection must be provided against cattle, &c., either collectively or individually by means of tree-guards or fence, until the trees are sufficiently established to take care of themselves.
(g) The injudicious cutting of branches, or interference with the growth and proper form of trees in public thoroughfares, should be considered an act punishable by law.
(h) The building of houses, huts or shanties too close to the trees should be prohibited.

SHADE TREES SUITED FOR THE MOIST LOW-COUNTRY.

[Elevations below 2,000 ft. with average annual rainfall of 70 in. or more].

For Road-sides :—

[S.=Sinhalese; *T.*=Tamil].

Canarium commune. Java Almond; "Rata-kekuna" *S.* A large Malayan tree. See under *Tropical Fruits.*

Filicium decipiens. "Pehimbiya" *S.* "Katu-puwarasa" *T.* An elegant evergreen tree, 50 to 70 ft. high. See *Ornamental Foliage Trees.*

Lafoensia Vandelliana. An erect, medium-sized tree with small leaves, native of Brazil; introduced at Peradeniya in 1865.

Myroxylon toluiferum. Balsam-of Tolu; "Rata-karanda," *S.* A large handsome tree with small pinnate leaves, native of S. America. See under *Important Timbers, &c.*

Parkia Roxburghii. An immense tree with fine feathery leaves, native of Malaya. See *Ornamental Foliage Trees.*

Peltophorum ferrugineum. A handsome foliage and flowering tree, with fine feathery leaves, native of Ceylon. See *Beautiful Flowering Trees.*

Pithecolobium Saman. "Saman;" "Rain-tree;" Guango; "Peni-karal," *S.* A very large quick-growing tree, with small pinnate leaves, excellent for road-sides ; introduced into Ceylon from S. America in 1851.

Pometia eximia. "Gal-mora" *S.* A large handsome tree with a round head See *Ornamental Foliage Trees.*

Pterocarpus indicus. Padouk; "Rata-gammalu" *S.* A large handsome tree with fine foliage and drooping branches. See *Ornamental Foliage Trees.*

Terminalia belerica. Myrobalan-tree; "Bulu" *S.* "Rani-maran" or "Tanti," *T* A very large handsome tree. See *Ornamental Foliage Trees.*

For Parks or Open Spaces :—

[See the above, also *Ornamental Foliage Trees*].

For Field Crops, as Tea, Cacao, Etc :—

Adenanthera pavonina. *(Leguminosae).* Bead-tree; "Madatiya" *S.* A moderate-sized, straight tree, with small pinnate leaves.

Albizzia moluccana. *(Leguminosae).* Sau Tree ; "Rata-mara *S.*
Albizzia stipulata, (*Leguminosae*). "Kabal-mara" *S.*
} Large, very quick-growing trees, with thin feathery foliage ; in flower Dec. to Jan.

Erythrina lithosperma. (*Leguminosae*). "Dadap," A moderate-sized tree of rapid growth, suitable for shade; also affords a quantity of foliage for mulching or geeen-manuring.

Erythrina umbrosa. (*Leguminosae*). "Immortel" or "Mortel." A moderate-sized tree with large leaves, much used as a shade tree for Cacao and other crops in the West Indies.

Erythrina velutina. (*Leguminosae*). "Bocare." A popular shade tree for Cacao in the West Indies.

Gliricidia maculata. (*Leguminosae*). "Madre," or "Madura." A small quick-growing tree of Nicaragua, suitable as a shade tree for Cacao, &c. See *Beautiful Flowering Trees.*

Grevillea robusta. (*Proteaceae*). Silky Oak. An upright medium-sized tree of Australia, with light foliage, much planted for shade amongst Tea, also for wind-belts, fuel reserve, &c., in Ceylon. Thrives best from 1,500 to 4,000 feet.

Inga laurina. (*Leguminosae*) "Pois-doux." A small tree, used in the West Indies as a shade tree for Cacao.

Myroxylon toluiferum. (*Leguminosae*). Balsam-of-Tolu. Suitable as a permanent shade tree for field crops. See *Ornamental Foliage Trees.*

For Timber, Wind-Belts, and Fuel:—

[See also *Important Timbers, etc., of the Tropics*].

Artocarpus integrifolius. Jak; "Kos," *S.* A moderate-sized or large tree, affording excellent timber, suitable for wind-belts and timber reserve.

Cassia siamea. "Wa" *S.* A large quick-growing tree, yielding hard dark timber and good fuel.

Casuarina equisitifolia. "She Oak" "Beef-wood;" "Kassa-gaha," *S.* Suitable for wind-belts; very hard, durable timber and good fuel.

Eugenia Jambos. "Jambu." A small bushy tree, suitable for wind-belts.

Filicium decipiens. "Pehimbiya," *S.* A slow-growing tree, suitable for wind-belts; excellent timber and fuel.

Melia dubia. "Lunu-midella" *S.* A handsome quick-growing tree. Wood light, much used for ceilings.

Mesua ferrea. Ceylon Iron-Wood; "Na-gaha" *S.* Slow-growing, thick foliaged tree; would make effective and permanent wind-belts.

Michelia Champaca. Champac; "Sapu" *S.* A large quick-growing tree, affording good timber and fuel.

Mischodon zeylanicus. "Tammanu" *S.* "Tampanai" *T.* A small much-branched tree, suitable for wind-belts; excellent timber.

Myroxylon toluiferum. Balsam-of-Tolu. A moderate sized or large tree; good timber, suitable for wind-belts.

Pterocarpus marsupium. "Gammalu" *S.* A wide-spreading handsome tree; fine hard timber.

SHADE TREES SUITED FOR THE INTERMEDIATE OR SEMI-DRY REGION.

[With rainfall of 50 to 70 inches].

For Roadsides:—

Albizzia Lebbek. "Mara" *S.* "Woman's Tongue" of the West Indies; native of Ceylon and Eastern Tropics.

Azadirachta indica. "Kohomba" *S.* "Margosa"; "Vempu" *T.* A moderate-sized tree, with straight trunk and spreading branches; suited for dry region.

Caesalpinia coriaria. Divi-divi.—See *Tannin Products*.

Diospyros Embryopteris. "Timbiri" *T.* A moderate-sized evergreen tree with spreading branches.

Eucalyptus alba. White Gum-tree. A tall slender tree with smooth grey bark, native of N. Australia; thrives and bears seed at Anuradhapura, Ceylon.

E.—citriodora. Lemon-scented Gum-tree. A handsome slender tree, with smooth bark.

Mischodon zeylanicus. "Tammanu" *S.* "Tampanai" *T.* A much-branched tree, 30 to 40 feet high, suited to dry region.

Myristica laurifolia. "Wild Nutmeg" "Malaboda" *S.* "Palmanikam" *T.* A large tree with wide spreading branches and large leaves; thrives in rather dry as well as moist region.

Peltophorum ferrugineum. "Iva-vakai," *T.* A moderate-sized or large much-branched, handsome tree, indigenous to dry region of Ceylon. See *Beautiful Flowering Trees*.

Pithecolobium (Inga) Saman. "Saman;" "Rain-tree," "Peni-karal," *S.* See *Shade Trees for Moist Low-country.*

Poinciana regia. Flamboyante. See under *Beautiful Flowering Trees.*

Polyalthia longifolia. "Mara-illupai" *T.* A handsome evergreen tree, suitable for avenues and road sides.

Pterocarpus marsupium. "Gammalu" *S.* (See above). Suited to moderately dry region.

Swietenia macrophylla. Large-leaved Mahogany. A large handsome tree, suited to dry districts.

Tamarindus indica. Tamarind; "Siyambala" *S.* "Puli" *T.* A large handsome tree, adapted to a dry as well as moist region.

Thespesia populnea. Tulip Tree; "Suriya" *S.* "Kavarachu" *T.* A small much-branched spreading tree, with ovate pointed leaves, Indigenous to the dry region of Ceylon near the sea, often planted as an avenue or shade tree. See *Important Timbers of the Tropics.*

For Parks, Pasture Lands, Avenues, Etc.:—

Same as above.

SHADE TREES SUITED FOR MEDIUM ELEVATIONS.

(2,000 to 5000 ft.; Rainfall 70 to 140 inches).

For Road-sides, Pasture Land, and Open Spaces:—

Acacia melanoxylon. Blackwood. A large tree, furnishing excellent timber.

Acacia pycnantha. Golden-wattle. 30 to 40 ft. high; good timber, valuable tannin bark.

Albizzia moluccana. Sau Tree; "Rata-mara" *S.* A large quick-growing tree; thrives from 1,000 to 3,500 ft. Thin feathery foliage.

A.—stipulata. "Kabal-mara" *S.* (See above).

Castanospermum australe. Moreton Bay Chestnut. A medium-sized tree, thrives from 1,000 to 3,000 ft.

Cedrela serrata. Red Toon **C.—Toona.** Toon-tree; Indian Mahogany.	Quick-growing handsome trees; good timber and shade. Thrive up to 6,000 ft.

Cullenia excelsa. "Wild Durian." A symmetrical, spreading, evergreen tree; thrives up to 3,000 ft.

Grevillea robusta. Silky Oak. (See above). A useful and ornamental tree with fine feathery foliage, excellent for shade, wind-belts and fuel; also affords serviceable timber.

Pterocarpus marsupium. "Gammalu" *S.* Thrives up to 3,000 ft. (See above).

Schinus molle. "Pepper Tree." A handsome, spreading, small tree with pinnate leaves. See *Ornamental Foliage Trees for Up-country.*

For Timber, Wind-belts and Fuel:—

(See also *Important Timbers of the Tropics.*

Acacia pycnantha.	(See above)	Cedrela serrata.	See above.
Albizzia moluccana.	,,	Cedrela Toona.	,,

Eucalyptus Leucoxylon. Iron-bark Tree. A large Australian tree, affording very hard, durable, and strong timber, used by cartwrights and ship-builders,

E.—marginata. Jarrah.—An Australian tree, yielding valuable, durable timber, resistant to termites and other insects; largely used for sleepers, street-paving, jetty-building, &c,

E.—robusta. Iron-bark. An upright tall tree, with rough brown bark, much planted for timber and fuel reserves at elevation of 3,000 to 5000 ft. in Ceylon.

Grevillea robusta. Silky Oak. (See above).

Michelia Champaca. "Sapu" *S.*—A large quick-growing tree; good timber and fuel; thrives up to 2,000 ft.

For Field Crops, Tea, Etc:—

(See also Shade Trees suited for crops in Low-country).

Acacia dealbata. Silver-wattle. See *Ornamental Flowering Trees.*

A.—molissima = (A. ducurrens). Black or Tan-wattle. A large Australian Tree, commonly grown at the higher elevations in Ceylon. (See *Tan Barks.*)

Acrocarpus fraxinifolius. A handsome quick-growing Leguminous tree.

Albizzia moluccana. (See above) }
A.—stipulata (,,) } Thrive up to about 4,000 ft. in Ceylon.
Erythrina lithosperma (,,) }

Cedrela serrata. Red Toon. (See above) }
Grevillea robusta. Silky Oak (,,) } Thrive from 2,000 to 6,000 ft.

TREES SUITED FOR WIND-BELTS, TIMBER, AND FUEL.

For Elevations above 4,000 Ft.

Acacia decurrens. Black or Tan-wattle. (See above).

A.—melanoxylon. Blackwood. A large tree, furnishing excellent timber (See *Ornamental Foliage Trees*). Also several other species of Acacia.

Calophyllum Walkerii. "Kina" *S.* A large tree, with a thick straight trunk and a round head; common at the higher elevations in moist region. Good wind-belt tree. Peculiar to Ceylon.

Cedrela serrata. Red Toon. See above; also *Ornamental Foliage Trees.*

Cupressus Knightiana. Conifer. }
C—macrocarpa. ,, } Large, quick-growing, handsome trees, useful for timber, fuel and wind belts. See *Ornamental Foliage Trees for Up-country.*

Eucalyptus Leucoxylon. Iron-bark Tree. See above.

E.—marginata. Jarrah. A large tree of Western Australia, affording one of the most durable timbers known (See above). Also several other species of Eucalyptus.

Frenela rhomboidea. A moderate-sized, handsome, coniferous tree, good for timber, fuel, &c.

Grevillea robusta. Silky Oak.—See above.

Michelia nilagirica. "Wal-sapu" *S.* A moderate-sized shrubby tree, with a round head, common in moist forests above 4,000 ft. One of the best of indigenous mountain timbers in Ceylon.

Schinus molle. "Pepper Tree." A handsome, spreading, small tree, with fine feathery foliage. See *Ornamental Foliage Trees for Up-country*

CHAPTER XXI.

RAILWAY, SCHOOL, AND RESTHOUSE GARDENS.

[For fuller information, see special Chapters on different subjects].

The vicinity of Railway Stations, Schools and Resthouses affords in many cases excellent opportunities of establishing attractive and useful little gardens, often in isolated or sparsley cultivated districts, and are thus capable of serving as object lessons to the peasantry, in addition to their primary purpose of ornament or utility. Through their agency useful and ornamental plants may be introduced and established in remote districts, and they may be the means of demonstrating the kinds of plants most adapted to the particular climate and soil of their locality. The most cheerless and bleak situations may be made attractive and interesting by establishing and maintaining neat little gardens suitable to the surroundings, and the effect of these also in rendering a vicinity salubrious and agreeable can hardly be over-estimated.

Laying out and Planting.—The outline of the garden being decided upon, the boundary should be planted with suitable trees for the purpose of providing shade or shelter. These should be planted closer than they are intended to remain when grown up, allowance being thus made for thinning out as the trees approach maturity. Deciduous trees should not, as a rule, be planted for shade, as they are likely to drop their leaves when shade is most required. In planning the garden, it may help to make one's idea clear by first sketching on paper the general contour of the ground and the outline of the scheme it is proposed to follow, afterwards marking off the space with string and pegs. The plan to be carried out should, of course, depend on the area, whilst the labour available for carrying on the work and maintaining the garden in a proper condition must also be considered. Therefore, never make a garden larger than you can manage to maintain in good condition. A small garden well kept is obviously preferable to a larger one which always presents an untidy or neglected appearance. Persons in charge of Resthouses and Railway gardens in Ceylon

STATION PLATFORM GARDEN, HENERATGODA, CEYLON.

frequently make the mistake of thinking that a great number of miniature beds and borders, sometimes but a few inches in width and of fantastic outline, constitute an attractive garden. Such geometrical figures are neither ornamental nor practical, being unsuitable for the growth of most ornamental plants, and too small and intricate to allow of their being maintained in a proper condition. These should, therefore, be discouraged. Simple beds of moderate dimensions, either oblong, round, or oval in shape, and borders of suitable width and natural curves are much more preferable.

Borders are, as a rule, best confined to the outskirts of the garden, where they should be planted with tall shrubs so as to form a striking background for the smaller plants and beds in front. Flower-beds may be dotted about the lawn and by the sides of paths, but care should be taken to leave the centre of the garden as open as possible. Where only a narrow strip of ground is available, as at some railway stations, no elaborate design should be attempted; a bold border consisting of mixed ornamental shrubs for a background, finishing with smaller plants in front, being in such cases the most practical and effective arrangement. The ideal small garden should present a striking background of tall shrubs and shady flowering-trees, with beds of gradually smaller plants in the foreground, the latter being set in a smooth level lawn, with plenty of space between them. This will present the best effect when looked at from the front, as from the railway carriages.

Paths.—These should always be wide enough for two persons to walk comfortably abreast, and may be either straight or gracefully curved. It must be remembered that they are meant for convenience rather than ornament; therefore avoid having any more than are necessary. Cleanly kept paths, of uniform width and with neatly trimmed edges, add greatly to the general effect of a garden.

Hedges.—It is essential at the outset to guard against vermin and wandering cattle, and also in some places against deer, porcupines, etc., so that protection by means of a wall, a paling of old sleepers, or a good barbed-wire fence is usually indispensable. When such is employed, it should be concealed and beautified by showy climbers, or by a neat hedge of ornamental shrubs. A live fence or hedge of some formidable prickly plant may in itself, in some cases, afford an efficient barrier when well established.

SCHOOL GARDEN, MIRIGAMA, CEYLON.

Climbers.—Ornamental climbers can be used with charming effect over bamboo or iron arches, twined round tree trunks or trained in festoons between pillars. They may also serve useful purposes in screening off an unsightly outhouse or shading an exposed verandah. Climbers, however, may be injurious to buildings if allowed to grow unchecked over the roof, and should therefore be kept within bounds.

Lawns.—The beds or borders should be so arranged as to leave plenty of working space between them, and this should, whenever feasible, be laid in turf so as to afford all the lawn possible. The latter forms the best setting, and if well kept will not only increase the ornamental effect of the plants, but will in itself always present a very attractive and pleasing appearance. A lawn is easily produced, and when made entails less labour in upkeep than the same area laid out in fanciful strips of paths and borders. The ground should first be dug up and uniformly levelled ; the surface may then be covered with turf, or, if this is scarce, roots of grass may be dibbled in at three or four inches apart, and the surface afterwards rolled. Seed of any good local turf grass, as "Tutteri," if sown and covered with a sprinkling of soil will soon form a green sward. Wet weather should, of course, be chosen for any work of this nature. When the turf is well established the grass should be kept short, which may easily be done by an edged bamboo splint, if a small lawn mower is not available.

Upkeep.—However well a garden may be laid out and planted, its usefulness and attractiveness will depend upon how the grounds and general surroundings are looked after. As a rule it may be accepted that the condition of a garden invariably reflects the extent of personal interest of its owner or the person in charge. Keeping the grass short and the turf uniformly level, the paths clean-weeded with neatly cut edges, hedges neatly trimmed, weeding, forking, and mulching the soil—these are operations which should never be neglected, and go far to make a perfect garden.

Propagation.—Simple propagation, as by cuttings, division of roots or bulbs, etc., may easily be carried out in small gardens, as at Railway stations, Resthouses, Schools, etc. Too often valuable plants are allowed to run out of stock, and the Government Gardens are expected to replace them when required. All that is necessary is a bed of loose rich soil in a shady corner. This should be dug to about 2 feet deep, so as to afford good drainage and encourage the retention of moisture in the soil in dry weather. Remove any

SCHOOL GARDEN, VEYANGODA, CEYLON.

coarse stones, roots, etc., and place on the surface a layer of fine soil, to which should be added some leaf-mould and fine river-sand. Very little attention is required beyond shading and watering the beds when necessary. The advantages of this practice are obvious, for not only are the plants thus ready at hand when required for planting out or for filling vacancies, but the supply of special kinds suitable for definite purposes or locality can be relied upon.

SELECTED FLOWERING AND FOLIAGE PLANTS, ANNUALS, CLIMBERS, Etc.

Suitable for Gardens from Sea-level to 6,000 Ft. Elevation.

See also Selections for Low-and Up-country.

Flowering and Foliage Plants, 5 ft. to 8 ft. high:—

(Sea Level)

- **Lagerstrœmia indica.** Flowers pink
- **Tabernamontana coronaria.** Flowers pure-white
- **Croton.** Different varieties. Ornamental foliage
- **Palms.** Different varieties. Handsome graceful foliage
- **Acalypha.** Different varieties; large coloured leaves.
- **Pisonia alba.** (Lettuce-tree). Greenish-yellow foliage
- **Arundo Donax.** Large variegated grass
- **Hibiscus.** Different varieties. Showy flowers
- **Amomum magnificum.** Ornamental leaves, showy flowers
- **Poinsettia pulcherrima.** Showy scarlet flowers
- **Heliconia aureo-striata.** Large ornamental plantain-like leaves
- **Panax fruticosum.** Ornamental feathery leaves
- **Cordyline.** (Dracæna). Ornamental, purple, crimson, or bronze leaves
- **Aralia filicifolia.** Ornamental feathery leaves
- **Mussænda erythrophylla.** Showy scarlet flowers
- **Gardenia florida.** White, scented flowers
- **Kopsia fruticosa.** Pink and white flowers
- **Plumeria rubra.** Red Temple-tree. Crimson flowers

Low plants suitable for beds, front rows, or edging:—

- **Cannas.** Numerous varieties. Flowers yellow, scarlet, pink, etc. Leaves large, green or bronze
- **Vinca rosea.** Pink or white flowers
- **Coleus.** Different varieties. Ornamental foliage
- **Caladiums.** Different varieties. Ornamental foliage
- **Alternanthera.** Several varieties. Dwarf plants, useful for edging
- **Coreopsis.** Yellow flowers
- **Ageratum.** Blue flowers
- **Angelonia.** Bluish-purple flowers
- **Cosmos.** Pink and white flowers
- **Ananas variegata.** Ornamental foliage
- **Turnera elegans.** Creamy white flowers, closing in afternoon
- **Gynandropsis.** Large pink blossom
- **Torenia Fournieri.** Small plant, violet-blue and white flowers
- **Chrysanthemum.** Perennial. White-flowered varieties the best.
- **Gomphrena globosa.** Purple flowers
- **Phrynium variegatum.** Ornamental variegated foliage
- **Salvia farinacea.** Blue flowers
- **Pentas carnea.** Pink flowers
- **Ruellia colorata.** Purple leaves, perennial, creeping
- **Salvia.** Scarlet flowers
- **Petunia.** Showy purple or white flowers
- **Cuphea jorullensis.** Flowers orange-yellow
- **Marigolds.** Flowers showy, yellow, orange, etc.

CLIMBERS:—

Solanum Wendlandii. Blue flowers

(1,500 ft.)

Allamanda Hendersonii. Large yellow flowers
Bignonia magnifica. Beautiful magenta flowers
B.—unguis. Bright yellow flowers
Cissus discolor. Pretty, satiny coloured leaves
Antigonon leptopus. Pink flowers
Clerodendron Thomsonae. Beautiful white and scarlet flowers
Petræa volubilis. Beautiful blue and violet flowers

Congea tomentosa. Showy pink flowers in large sprays

CLIMBERS.

Ipomœa Briggsii. Dark crimson flowers
Bignonia venusta. Tanga-poo. Flowers orange-yellow
Solanum seaforthianum. Blue flowers

FLOWERING AND FOLIAGE SHRUBS.

(3,500 ft.)

Pavetta indica. Flowers white
Russellia juncea. Flowers scarlet
Sanchezia nobilis. Ornamental variegated leaves
Strobilanthes coloratus. Flowers dark purple
Montanoa bipinnatifida. Tree-daisy. Flowers white
Graptophyllum hortense. "Caricature Plant." Variegated foliage
Tecoma Stans. Yellow flowers

Beloperone oblongata. Pink flowers

FLOWERING AND FOLIAGE SHRUBS.

Duranta Plumieri. Pale blue flowers

(4,500 ft.)

Plumbago capensis. Pretty blue flowers
Berberis cristata. Yellow flowers
Pleroma macranthum. Large violet flowers
Bocconia frutescens. Large ornamental leaves
Iresine Herbstii. Ornamental variegated foliage
Musa coccinea. Flowering-banana; scarlet flowers
Streptosolen Jamesoni. Showy orange-red flowers
Brunfelsia uniflora. Bluish-white flowers
Hedychium coronarium. Flowers white, scented

SHOWY FLOWERING ANNUALS.—

Acroclinium. Everlastings, pink and white
Asters.
Balsams.
Browallia.
Celosia, or Cock's Comb
Chrysanthemums (Annual).
Clarkia. Pink flowers
Candytuft. White or purple
Cosmos. Pink and white
Dianthus. Indian pink
Exacum macranthum.
Larkspur.
Linaria.
Linum.
Mignonette.
Nemesia Six to eight inches high.
Nicotiana. Different varieties
Petunia. Single
Phlox Drummondii.
Poppies
Portulaca. "Sun plant;" dwarf
Salpiglossus.
Schizanthus.
Verbena.
Zinnia

BULBOUS AND TUBEROUS PLANTS.

Agapanthus umbellatus. Lovely blue flowers
Ixia pendula. Orange-yellow
Hippeastrum. Different varieties; large showy flowers
Dahlias. Purple, yellow, scarlet, etc.
Tritonia aurea. Orange-yellow
Cyrtanthus. ("African Bride"). White or pink, scented.
Cannas. Yellow, scarlet, etc.
Heliotrope. Blue flowers
Roses. Different varieties.
Hydrangea Flowers blue or white
Vinca (Periwinkle). Blue or white

FLOWERING AND FOLIAGE SHRUBS.

Datura fastuosa. Flowers large, white
Cestrum (Habrothamnus) elegans. Bears bright crimson berries
Libonia floribunda. Orange-red flowers
Fuchsia arborescens. Showy lilac flowers
Spiræa peruviana. Creamy white flowers

POT-, BORDER-PLANTS, ETC.

Cineraria. Blue, white, scarlet, etc.
Chrysanthemums, perennial; white, yellow, etc.
Violets. Blue, violet, purple, white
Daisies. White, scarlet, etc.
Geraniums. Scarlet, pink, white, etc.
Santolina ("Cotton Lavender"). White cottony foliage, scented
Pansies. Different colours
Sweet Pea. Various shades.

ORNAMENTAL CLIMBERS:—

Cobæa scandens. Large plant; flowers purplish white
Mandevillea suaveolens. Chili Jasmine. Flowers large, pure white
Schmidia (Thunbergia) bicolor. Flowers yellow and brown
Solanum jasminoides. Fl's. white, showy
Tacsonia. Different var's. Fl's. showy
Tropæolum (Nasturtium). Flowers yellow, etc.
Wistaria sinensis. Flowers beautiful pale-purple

TREES SUITABLE FOR MEMORIAL PURPOSES

[For descriptions, see chapters on Beautiful Flowering and Foliage Trees]

For the moist Low-country:

FINE FLOWERING TREES:—

Amherstia nobilis
Brownea grandiceps
" macrophylla
Cassia grandis
" multijuga
" nodosa
Couroupita guianensis. Cannon-ball Tree
Jacaranda mimosæfolia
Lagerstrœmia Flos-reginæ. Pride-of-India; "Murutu."
Peltophorum ferrugineum
Plumeria acutifolia. Temple tree
" rubra. Red "
Poinciana regia. Flamboyante
Schizolobium excelsum
Spathodea campanulata

FOR THE DRY REGION:—

Cassia Fistula. "Ehela;" "Indian Laburnum"
Plumeria acutifolia. Temple Tree
P.—rubra. Temple Tree, crimson-flowered.
Polyalthia longifolia
Tamarindus indica. Tamarind
Thespesia populnea. Tulip Tree

HANDSOME FOLIAGE TREES:—

Agathis robusta
Araucaria Bidwillii
Artocarpus incisa. Bread-fruit
Canarium commune. Java almond
Enterolobium cyclocarpum
Ficus Benjaminii. "Java willow"
Filicium decipiens. "Pehimbiya"
Mesua ferrea. Ceylon Ironwood Tree
Myroxylon toluiferum. Balsam-of-Tolu
Parkia Roxburghii
Pometia eximia
Podocarpus cupressinus
Pterocarpus indicus
Schizolobium excelsum
Swietenia macrophylla. Large-leaved Mahogany

UP COUNTRY:—

Araucaria Bidwillii
Cupressus, different species and other Coniferae
Eucalyptus, different species
Frenela rhomboidea
Grevillea robusta
Stenocarpus sinuatus
Syncarpia laurifolia

SUITABLE PLANTS FOR CEMETERIES

For descriptions, see special chapters on Flowering and Foliage Plants, etc.

Dwarf or slow-growing plants, which are either evergreens or produce white flowers, are the kinds usually desired for planting on or around graves. The following are selected species for the purpose:—

FOR LOW ELEVATIONS

TREES, ETC:—

Casuarina equisitifolia
Cupressus funebris. "Weeping Cypress"
Cycads (Ceylon "Madu")
Palms: Chrysalidocarpus, Areca, Caryota, etc.
Plumeria acutifolia. "Temple tree"
Thuja orientalis. "Arbor Vitae"

FLOWERING SHRUBS WITH WHITE OR BLUE FLOWERS:—

Brunfelsia americana; flowers cream
B.—uniflora ; flowers white and blue
Clerodendron macrosiphon ; flowers white and pink
Heeria macrostachya; flowers cream
Plumbago capensis; white and blue-flowered varieties
Tabernaemontana coronaria; Flowers pure white
Vinca alba. Fl's white
Wrightia zeylanica; flowers pure white

DWARF OR EDGING PLANTS:—

Alternanthera; dwarf plants for edging, etc.
Amaryllis; white-flowered varieties
Caladium argyrites; small variegated white and green leaves
Coleus; handsome velvety variously-coloured foliage
Eucharis lily; pure white flowers
Eurycles; white flowers
Ophiopogon; creamy white flowers
Pancratium zeylanicum; pure white flowers
Phalaris arundinacea; small variegated grass
Salvia farinaceae: pale blue flowers
Tuberoses; creamy-white flowers, scented
Vinca alba; white flowers
Zephyranthes; white flowers (tuber)

FOR UP-COUNTRY:—

Alternantheras; dwarf foliage plants suited for edging, etc.
Amaryllis Belladona, Belladona lily; pink flowers
Carnations; flowers white, crimson, etc.
Coleus; handsome foliage; (see above)
Crinum Moorei; white fl's (tuber)
Cyrtanthus Mackenii; white flowers
Eurycles; white flowers (tuber)
Hydrangea; white or pale blue flowers
Pancratium; white flowers (tuber)
Santolina; Cotton Lavender, pale grey scented foliage
Sweet-william; white and pink flowers
Tuberose; white fl's; see above
Vinca major; Periwinkle; creeper, flowers pale blue
Zephyranthes; white flowers (tuber)

Also various white-flowering annuals, etc.

AGRI-HORTICULTURAL SHOWS

Hints on Forwarding and Arranging Exhibits

Procure in good time a catalogue or schedule of the forthcoming Show; go carefully through the various classes, when possibly some of the prizes offered will suggest themselves as within your scope.

1.—If time permits, sow or plant crops of vegetables, flowers, etc., to allow them to grow and mature in time for the Show; the period required in each case will depend on the nature of the crop, as well as on local conditions of climate or soil.

2.—If in due course you are satisfied that the result of your efforts will make at least a creditable exhibit, write to the Secretary of the Show, intimating the articles which you wish to exhibit, and state the space you require for them.

3.—In selecting exhibits, adhere to the rules laid down in the catalogue, especially in regard to number or quantity required; disregard of these particulars may disqualify an exhibitor.

4.—Show-rules usually state that exhibits which have not been grown by the exhibitor or his employer for at least two months before the exhibition will be disqualified. This does not necessarily apply to flowers for table decorations.

5.—In transporting delicate fruits, such as oranges, mangoes, mangosteens, sapodilla, tomatoes, etc., they should be packed in shavings, sawdust, or some soft material to prevent them from being bruised. Smaller fruits, such as uguressa, kon, strawberries, etc., may be packed in layers with their own leaves; whilst large kinds, such as plantains, pineapples, durians, jak, etc., should be packed with dry straw or shavings, in crates or well-ventilated boxes.

6.—Plants should be sent in crates, and the stems, leaves or flowers securely tied and held in position. Support the stems, of flowering annuals in pots. Avoid obtrusive pots, stakes, or ties. See that, before despatch, the pots or tubs are well wrapped in straw or shavings, and bound round so as to prevent the soil from being shaken or tipped out.

7.—Wash root-crops carefully before sending to a Show, and cut off all unnecessary roots.

8.—Remember that quality counts for more than quantity—that vegetables, fruits and other edible products should be in a reasonably fit state for consumption when exhibited, it being impossible to properly judge under-ripe or over-mature articles. Therefore do not send fruit in an unripe or over-ripe state.

9.—The impression your exhibit makes on the judges is largely dependent on the manner it is arranged. Do not stage small articles in large and unsightly receptacles, such as cadjan baskets, with their contents usually hidden at the bottom. See that pots, tubs or other receptacles containing plants are properly washed.

10.—Fruits, vegetables, herbs, etc., should be shown in shallow basket-trays or plates of uniform sizes. Fruits, especially small kinds, are rendered more effective by having a few of their own leaves arranged neatly around them. Parsley, or similar foliage, as Panax, affords an excellent material for decorating and displaying exhibits to best advantage.

11.—Cut-flowers should have their stalks placed in water immediately after cutting; these will keep longer if, when being trimmed, their stalks are cut under the water instead of in the air.

12.—Overcrowding of exhibits, especially as regards plants and flowers, should particularly be avoided, for exhibits of first-rate quality often fail to make an impression by a disregard of this rule.

13.—The value of an exhibit will be much enhanced if a label is fixed to it giving the name under which it is commonly known also, if possible, the scientific name; this will secure points in the judging and add interest to the Show; it is one of the most important considerations at floral exhibitions in England, and applies particularly to such exhibits as Roses.

14.—Flowers which naturally grow in clusters, as Verbena, Phlox, Schizanthus, etc., are best shown in bunches; while blooms of a large size as Dahlia, Hibiscus, etc., are seen to best advantage when displayed singly.

15.—Though bottles or tins, if of uniform size and securely held in position, may answer the purpose of displaying cut-flowers at an exhibition, the proper thing to use so as to show the flowers to the best effect as well as to facilitate arrangement, is an *exhibition box*. This may be made of any light wood, on the principle of a writing desk, and painted green. The size may vary according to requirements, but for all practical purposes the

following are suitable dimensions: 3 ft. 9 in. long, $1\frac{1}{2}$ ft. broad, 7 inches high at the back, and 5 inches in front. The cover is 6 inches in depth at the back, and 8 in front, being $1\frac{1}{2}$ inches longer and wider than the box, and having a narrow beading within the four sides, half an inch from the bottom of the lid, which overlaps the box, leaving ample room for the blooms.

16.—Lids of wooden cases should be *screwed*, not nailed down, or, better still, hinged and if necessary locked with a padlock. Packages should be addressed clearly and fully, and marked URGENT; when closed, the top should be marked THIS SIDE UP, and FRAGILE when containing glass or breakables.

17.—Fruits which have an objectionable odour, such as Durian and Jak, especially when cut open for judging, should not be placed among the more attractive exhibits, but confined to an isolated corner or shed.

JUDGING AT SHOWS

General Rules for Societies and Judges

I.—To be an efficient judge, one should possess a practical knowledge of all the classes he or she has to judge, not only as they appear at the Show or on the market, but also preferably through their cultivation.

II.—It is usually advisable to appoint three judges to form a quorum, as this will enable a casting vote being given in cases of close contest.

III.—The system of judging by points, i.e., awarding a certain number of marks out of a possible maximum to different points or qualities of the exhibit, should be adopted where there is close competition.

IV.—The judging should always be done as punctually as possible and, needless to say, before the public are admitted to the Show. Frequently the judges have too much to do in the allotted time, which must result in their work being unduly hurried, or its being delayed until it has to be carried on in the presence of the public.

V.—The judges should be provided with ruled sheets of paper, on the left-hand side of which are written or printed the exhibits and prizes, with sufficient space allowed opposite these for the names of winners and any necessary remarks.

VI.—The executive committee should make a point of seeing that the exhibits are arranged as nearly as possible in the order in which they are given in the Show catalogue.

VII.—Societies should avoid offering prizes for classes which are not in season at the date of the Show, as this will limit the prizes which would be available for other classes, or bring forward inferior specimens, if any.

VIII.—The prize cards and rosettes should be of a uniform size and colour, according to their respective value, for all classes in the Show. Thus the first-prize cards should be *red*, the second-prize *blue* and the third or "highly commended" *lavender* or *yellow*.

SECTION 4.

CHAPTER XXII

STANDARD PRODUCTS OF CEYLON.

[S=SINHALESE ; T=TAMIL]

Cacao or Cocoa ; Chocolate Tree ; Chocolath-gas, *S.* ; Coco-maram, *T.* (*Theobroma Cacao.* Sterculiaceae).—A small tree, 20 to 25 ft. high, with large oblong leaves, native of tropical America, and cultivated extensively in its native home as well as in the West Indies, Ceylon, and West Tropical Africa. The tree bears a great number of small pinkish or yellowish flowers in bunches on the stem and branches, followed by the fruit ; the latter is a large warty or furrowed (sometimes pointed) pod, 6 to 9 inches long, red, yellow, or grey when ripe. Each pod contains from twenty-five to forty large seeds, closely packed in a column in the hollow centre and surrounded by a mucilaginous substance. Cocoa or chocolate is prepared by roasting the seeds, which are afterwards ground between hot cylinders to a paste (for chocolate), or mixed with sugar, starch, etc., for cocoa. "Cocoa butter" or "oil of theobroma" is obtained from the seeds by expression ; this is of special value in medicine, etc., and is used extensively.

Climate, Cultivation, and Harvesting.—The Cacao tree has a long tap-root, and requires deep and well-drained soil. It thrives best in a warm moist climate at elevations of 500 to 1,500 ft., but also yields good crops in a moderately dry climate, provided the annual rainfall is not below 60 inches. It is susceptible to exposure to the sun or strong winds, and must be afforded protection by means of suitable shade trees (such as species of Erythrina), planted 60 to 70 feet apart. Propagation is by seed (occasionally by bud-grafting), which must be sown fresh, preferably in plant-baskets. The seeds germinate in about three weeks, and the seedlings, which first grow at a rapid pace, are ready for planting out in three to four months from the time of sowing. The distance for planting apart should, under average conditions, be about 12 by 12 ft., though on good flat land it may be as much as 15 by 15 ft., while

on poor steep soil 10 by 10 ft. will be sufficient. In the West Indies, catch crops, such as Bananas, Tapioca, etc., are usually grown between the rows for the first year or two, both for the purpose of yielding an interim return and affording temporary

AMELONADO CACAO TREE.

shade to the young Cacao plants. Clean weeding is essential; very little pruning is necessary beyond removing superfluous suckers and dead or barren branches. Excessive pruning or thinning out is injurious, and exposes the fruits to the attacks of the insect

SHELLING CACAO PODS.

Helopeltis. The pods must be cut off, not pulled or torn; they are collected into heaps, then cut or broken open (*shelling*), the seeds (also known as "beans" or "nibs") being afterwards carried to the curing house, where they are heaped to undergo fermentation for about five or six days, the heaps being turned every other day. In Ceylon, but not always in other countries, the seeds are then well washed to get rid of the mucilage surrounding them, then dried either in the sun on barbecues, or under a movable roof. The drying process occupies from three to six days, according to the weather. Colouring the beans with clay, brick-dust, etc., is often practised in the West Indies and Venezuela in order to give them a fancy but fictitious appearance and polish; for this purpose annatto dye also is sometimes used. Polishing the seeds is generally essential for the sake of good appearance in the trade, and this is usually accomplished by rubbing them with the hands, or sometimes by "dancing" among them with bare feet, as is done in the West Indies.

CACAO PRUNING HOOK.

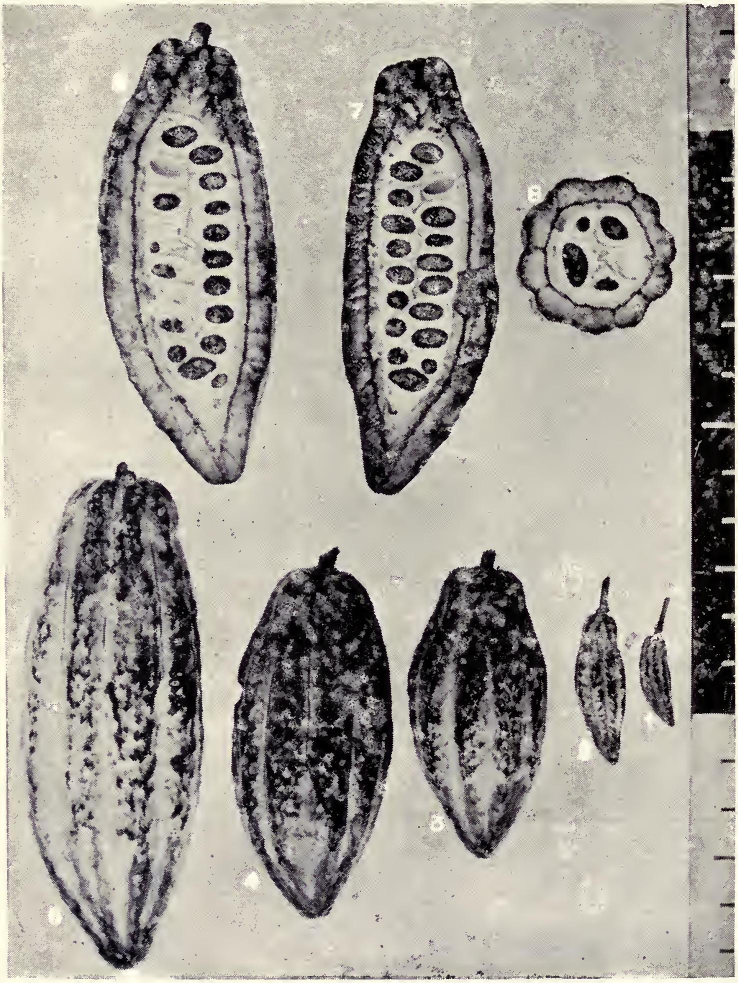
Yield.—The first crop is obtained in the fourth or fifth year from planting, but the trees will not be in full bearing until ten or twelve years old. Two crops a year are produced, the principal one (in Ceylon) from October to December, and the other from April to June. In a plantation, however, a few fruits will usually be found throughout the year. The yield should not be less than from 6 to 7 cwt. of cured beans per acre, though about 9 cwt. per acre is sometimes obtained.* An average crop of fifty pods per tree is considered good, but certain trees under very favourable circumstances may bear as many as 400 to 500 pods. "Forastero" pods contain on an average 32 to 35 seeds each. Fifteen average pods may be expected to give 1 lb. of made cocoa.

The Cacao tree was introduced into Ceylon about 1819, but its systematic cultivation was not undertaken till about 1878, when the first export of 10 cwt. (from 300 acres) was recorded. The present area under the product in Ceylon is estimated at approximately 28,000 acres, with an export of about 70,000 cwt. valued at over £200,000; the market price at present ranges from 60*s.* to 90*s* per cwt. according to quality and demand. The Gold Coast now shows the largest export of cacao of any country.

*An average of $9\frac{1}{4}$ cwt. for 800 acres has been obtained on Kondesalle Estate, Ceylon, in 1909.

CURING CACAO "BEANS" ON A BARBECUE IN THE SUN, IN CEYLON.

VARIETIES.—There are numerous more or less distinct varieties, which may be divided into two or at most three groups, viz., "Forastero" (=foreign) "Criollo" (=native), and "Calabacillo" (=small calabash); the last named



DEVELOPMENT AND STRUCTURE OF CACAO FRUIT.

Nos. 1 to 5—pods from 1 to 7 weeks old.
,, 6 to 8—Longitudinal and transverse sections of pods.

though long regarded as a form of Forastero, is now considered a distinct type. The typical Forastero has a thick and deeply furrowed bottle-necked pod, and is of a red or yellow shade; the seeds, which are large and numerous, are somewhat rounded, and purplish in section; the tree is a vigorous grower and

TYPES OF CACAO FRUITS.

Nos. 1, 2, & 3—Nicaragua Criollo.
No. 4—Theobroma pentagona.
No. 5—Amelonado.
„ 6—Criollo or Caracas.
Nos. 7, 8 and 9—Forastero.

usually a prolific bearer. Some of the best varieties of Forastero are "Cundeamar," "Amelonado," "Verdilico," and "Cayenne." The "Criollo" type (known in Ceylon as "Caracas" or "Old Ceylon Red"), which is apparently identical with the "Nicaragua," is distinguishable by its smaller, thin-shelled and red pods, with globular seeds which are usually white inside. The "Calabacillo" has usually a small and roundish pod with a smooth skin; beans flat, dark-purple inside. The "Criollo" variety generally commands the highest price, but the tree is of a delicate nature and liable to disease, as compared with the Forastero type.

Theobroma pentagona, or "Alligator Cacao," is a distinct species, introduced at Peradeniya from Trinidad in 1895. The pods are small and have five prominent ridges; the seeds are very large, but few, and white in section. It is highly spoken of in Trinidad, but at Peradeniya the tree is a very scanty bearer.

T. angustifolia.—"Monkey Cacao." A remarkable species introduced at Peradeniya in 1895, and fruited for the first time here in 1909. It bears large, hairy, brown and furrowed pods; the seeds are of no commercial value.

Cardamoms.—See *Spices.*

Cinnamon.—See *Spices.*

Coconut Palm; "Pol," *S.*; "Tennai" or Thénga, *T.* (*Cocos nucifera*).—To the inhabitants of Ceylon, where it is estimated there are some 900,000 acres under the product, and of other tropical countries where the coconut palm flourishes, this is one of the most important trees of the vegetable kingdom. Though extensively grown in most tropical regions, the original or indigenous home of the palm is unknown. It thrives best in a moist hot climate, especially near the sea, but will also succeed to a considerable distance inland where the climate is sufficiently hot and moist. In Ceylon, it is cultivated and gives good returns up to 1,600 ft. above sea level. Coconut cultivation, together with the preparation of its different products for market, forms a large industry in Ceylon. These include the following, of which very large quantities are exported, viz., copra (the dried inner portion (*endocarp*) of the nut broken in half, from which oil is obtained), coconut-oil, desiccated coconut (used in confectionery and cooking, and commanding a price of 22 to 25 cents per lb. locally), coir-fibre from the husks, and whole nuts to the extent of nearly 20 million a year. The local uses of the nut, leaves, stem and flowers for cookery and domestic purposes are innumerable, and in some cases almost sufficient to supply the total requirements of the poorer Natives.

Copra is usually dried in the sun or in specially constructed low houses or kilns, over the smoke and heat caused by smouldering fires made with the husks and shells. Forced hot air-driers are now used for the purpose, the copra shells being placed on movable trays; it is claimed that the copra is thus dried in 15 hours. The annual export of copra from Ceylon amounts to some 800,000 cwt., which usually fetches, according to quality and demand, from about £18 to £26 per ton, or Rs. 70 to Rs. 85* per candy; and of desiccated coconut about 14,000 tons. From 1,200 to 1,400 nuts usually go to a

COCONUT PALMS (*Cocos nucifera*), IN CEYLON.

candy of copra, and 4 candies make a ton. The extraction of the sweet juice from the base of the flowering spathe, obtained by incision and tapping, constitutes a large local industry. This juice unfermented, known as toddy, forms a pleasant sweet beverage; fermented and then distilled, it yields arrack—an alcoholic liquor consumed by the poorer as well as by many of the better classes. The best and healthiest trees are selected for the purpose of toddy drawing. Tapping for toddy may continue from 5 to 9 months, according to the climate, and the yield of the liquid may be from 100 to 180 gallons per tree in that period. The extraction of toddy

* The ruling price in Ceylon at present is Rs. 106 (£ 28) per ton, which is a record. August, 1913.

Coconut plantation, in the Low-country, Ceylon, showing method of using the husks for manuring, or rather for retaining moisture near the roots. The longitudinal dark slits on the two trees in foreground (right and left side) are old scars caused by the Coconut bleeding-disease.

means of course the sacrifice of the nut crop. According to the Ceylon Customs returns, desiccated coconut is exported from the Island annually to the extent of over 4 million pounds (valued at some £524,400), and poonac (residue of copra after expression of oil in local mills) of about a quarter million cwt. The latter is largely used as a nutritious cattle-food.

The palm likes moist alluvial or deep loamy soil, and flourishes especially on the sandy sea-coast, as well as on the banks of rivers. It is propagated by the nuts, which are sown in the husk in a nursery bed, being usually laid on their side and almost covered with fine soil. These germinate in about 3 months, and in six to ten months the seedlings are ready for planting out. The holes in which they are to be planted should be not less than 3 ft. deep by 3 ft. wide, and allowed to remain open for some time previous to planting. When the plants are put in, the holes should only be partially filled, leaving the crown of the plant, when planted, about a foot below the surface of the ground ; in course of time through the process of cultivation and weathering, the hole becomes filled up, and the tree is thus ensured a firm hold of the ground. The holes should be 25 or 27 ft. apart each way, according to soil, thus allowing 60 or 70 trees to the acre. A crop may be obtained in the 7th or 8th year from planting ; the trees are in full bearing at the age of 12 or 15 years, and continue productive until about 70 to 80 years old. They yield all the year round, and an aggregate annual return of 60 to 70 nuts per tree, or about 3,000 nuts to the acre, is considered a good yield. In the Straits, Sumatra, etc., a somewhat higher yield is usually obtained, the trees here being generally more prolific than in Ceylon, and come into bearing rather earlier. The trees attain a height of 70 to 80 ft., with an unbranched, wavy (never straight) stem. They are easily climbed by the Natives who, throwing their feet in a loop of cloth or fibre, pressed against the stem, are thus afforded a foot-hold. In Ceylon and South India the ripe nuts are picked by hand, but in some countries they are allowed to fall on the ground as they ripen, and then gathered.

VARIETIES.—A great number of varieties are in cultivation, these varying chiefly in the size, shape and number of nuts produced, also in thickness of the husk and of the interior, height of tree, etc. Some of the more distinct varieties are known by different local names. The *King Coconut* is a distinct variety, said to have originated in Ceylon; it bears a yellow oval fruit, which is distinguished by its sweet juice, and is esteemed for culinary purposes, but is

TERRACED RICE FIELDS IN CEYLON

of little value for copra. The *Dwarf Coconut* bears fruit when only two or three feet high, and the nuts are small in proportion. *Needle Coconut* is a distinct variety with a large triangular fruit, the nut having a sharp point at one end; it is cultivated in the Nicobar Islands. *Maldive Coconut* is characterized by a small, almost spherical fruit; while the *Edible-husked Coconut* is furnished with a husk which, when tender, is fleshy and of a sweetish acid taste.

Rice; Goyan, *S.* (*Oryza sativa.* Gramineæ).—Rice is the staple food of the native population of tropical Asia, where the plant is indigenous, and has been extensively cultivated from time immemorial. Its cultivation has in recent times spread to other tropical and sub-tropical countries, as the warmer parts of South

RICE HARVEST IN CEYLON,
Men and women cutting the crop with sickles.

America, West Indies, etc. The Rice plant is an annual grass, growing, according to variety and soil, from 2 ft. to 4 ft. in height, and its grain is considered to furnish the human race with a larger proportion of food than any other plant of the vegetable kingdom. The area under rice cultivation in Burma is estimated at 137 million acres, the export of the grain amounting to nearly 15 million pounds sterling.

There are numerous varieties, which come under two main types, (1) *common* or *aquatic rice*, and (2) *hill rice*. The former kind requires marshy or irrigated land and a hot climate (up to about 3,000 ft., in valleys), while the latter may be grown on dry land, and thrives up to about 4,000 ft. For the aquatic rice, a sandy loam, overlying a clayey subsoil (to prevent the water

draining away) is essential. Manuring is beneficial, sometimes indispensable, crushed bones or bone-dust, at the rate of about 200 lb. per acre, being among the most suitable forms of fertiliser. In India green-manuring is much practised for improving the soil. When water cannot be turned on to the land from streams or rivers, it has to be raised by mechanical means (often very primitive) from wells, etc., and in dry provinces, as in Egypt, India and parts of Ceylon, immense tanks or artificial lakes are constructed as reservoirs, the overflow from which supplies large tracts of irrigable land. In Ceylon, sloping or steep land is often rendered irrigable

THRESHING RICE IN CEYLON.

This is effected by buffaloes being made to walk in a circle, the rice being thrown under their feet to be trampled on. The operation is usually carried out in the cool of the night, and the animals are sometimes blindfolded to avert giddiness.

and suitable for rice cultivation by means of an elaborate system of terracing (see under *Irrigation*). Here in preparing the land for sowing, water is first turned on to soften the soil, which is then either ploughed, roughly dug by mamoties, or merely puddled by trampling teams of bulls or buffaloes. Before sowing, the seed is usually soaked for 24 hours, then covered with banana leaves or sacks and left for 6 days for initial germination to set in. In Ceylon, it is generally sown broadcast in the field, at the rate of about 2 bushels per acre. Transplanted rice, however, yields much greater returns, and only about a quarter the amount of grain is required to plant an acre; in this case the seedlings are transplanted to the fields when

7 to 8 inches high (or in 4 to 5 weeks from sowing), at distances of 6 to 8 inches apart, allowing 2 to 3 plants to the hole. In sowing, the ploughed muddy soil is first levelled with flat boards; the grain is then broadcasted, and when the latter has sprouted well the water is gradually turned on the field. The fields are kept flooded until the flowers appear, when the supply of water is reduced. When the grain is well formed, the water is turned off so as to hasten ripening and facilitate harvesting. Harvesting takes place in 3 to 7 months (according to variety) from the time of sowing, the shorter the period the smaller the crop as a rule. Two crops a year may be obtained in Ceylon, in the wet region: (1) the "Maha" crop (the principal one), sown in July or August and harvested in January or February; and (2) the "Yala" crop, sown in April and May and reaped in August and September. When the grain turns yellow, the crop is cut down with a sickle, tied in sheaves, and dried in the sun. Threshing in Eastern countries is often, if not usually, done by the trampling of bulls or buffaloes, these being tied in teams and made to walk in a circle, the rice being thrown under their feet. The grain is afterwards winnowed in the wind, then stored; hulling is done in wooden mortars, as required for consumption. The yield of rice varies considerably according to variety and mode of cultivation. The average return in Ceylon is about 25 to 35 bushels per acre, or about 15-fold. With good cultivation, however, 25 to 30-fold is easily obtained. Two bushels of paddy when hulled gives only about one bushel of clean rice. The whole production of rice in Ceylon, which is entirely in the hands of the Natives, is about 4½ million bushels per annum, against an import of about 8 million bushels (valued at over 50 million rupees) from India and Burma.

VARIETIES.—The Varieties of rice are almost innumerable, there being about 200 in Ceylon alone. These are distinguished chiefly by size, form and colour of grain, height of plant, also the period required to yield a crop. The latter is an important character, some varieties producing a crop in 60 days, while others take 6 or 7 months. The medium between these is usually preferred, as the earliest yielding varieties give but comparatively poor crops. The following are some of the principal varieties grown in Ceylon:—

Name of Variety.	Time of Sowing.	Time of harvesting.	Name of Variety.	Time of Sowing.	Time of harvesting.
Ma-vi (seven months' paddy):—			Hatili (six months' paddy):—		
"Kalukuru-mavi"	July	Feb.	"Gangala"	August	Feb.
"Muthusamba"	,,	,,	"Kalu-hatali"	,,	,,
"Sudu-mavi"	,,	,,	"Sudu-hatali"	,,	,,

Name of Variety.	Time of Sowing.	Time of harvesting.	Name of Variety.	Time of Sowing.	Time of harvesting.
Hondarawala (Five months' paddy):—			"Sudu-hinati"	Nov. & May	Feb. & Aug.
"Girisa"	August	Jan.	**El-vi or Hill paddy** (seven months' paddy):—		
"Kalu-kumara"	,,	,,	"Rat-el"	July	Feb.
"Kiri-narun"	,,	,,	"Suwand-el"	,,	,,
Bala-vi (four months' paddy):—			**Pol-el** (six months' paddy):—	August	Jan. and Feb.
"Kiri-kurumba"	Nov. & May	Mar. & Sept.	**Batukiri-el** (five months' paddy):—	,,	Dec. & Jan.
"Sittarakali"	Nov. & May	Mar. & Sept.	**Kalu-el** (four months' paddy):—	July	Nov.
"Pana-mora"	,,	,,	**Mada-el** (three months' paddy):—	August	,,
Hinati (three months' paddy):—					
"Kalu-hinati"	,,	Feb. & Aug.			

RUBBER (PLANTATION)

Rubber is obtained from certain trees, climbers, or shrubs, being extracted in the form of white milk or latex by means of incisions or pricks made in the bark (cortex). The supposition that latex is a waste product is doubtless incorrect, for it is maintained on good grounds that it is associated with certain functions, as the storage of food, water, and prevention of insect attacks, etc.

Tapping. The latex flows for a brief time from the said incisions or pricks, being collected in small tins or coconut shells, brought to the factory in enamelled buckets, and strained. In tapping, specially constructed knives or pricking instruments are employed for the purpose. These are sometimes used alternately, but generally the former are most in favour, for they enable the thinnest shaving being pared off the cut surface at each tapping. Pricking instruments are at present generally in disfavour, owing to their liability to injure the cambium and induce woody knobs on the tapping area. Different systems of tapping are employed, some being better adapted than others to certain species and to trees of different ages; but nearly all are on the principle of what are known as the "herring-bone" or "half-herring bone" (sometimes referred to as the "half-spiral") systems. Taking Hevea, the most important rubber tree, the tapping methods employed at present vary as experience may bring one or another into favour. A method in general vogue is to mark the circumference of the

stem, up to about 5 feet from the base vertically, into quarters; one quarter at a time or alternate quarters on reverse sides, may be operated on simultaneously. This area is marked off with 1 to 3 (now usually 2) wide V's cut about a foot apart vertically, and joined by a vertical central channel. For young trees with a small

SOME TAPPING KNIVES IN USE.

1. Pask's "Universal" Knife
2. Miller's Knife
3. Sculfer Knife
4. The Lanka Knife
5. The Scorpion Knife

circumference, the system of cutting a single large V or Y at 12 to 18 inches from the base of the stem has found favour, this being followed by a second V or Y cut on the reverse side, when the stem is large enough. A thin shaving (not less than 20 to the inch) is taken off the lower side of each cut every alternate day or so

until the intervening space of bark becomes too narrow or exhausted of latex, when the operation may be repeated on a fresh quarter of the stem. The tapping may thus be extended over almost the whole year. Each following year the opposite or adjacent quarter may be operated upon, the whole area thus occupying from 4 to 6 years, by which time the renewed bark on the first

1 2 3

TAPPING KNIVES.

1. Farrier Knife. 2. Barrydo Knife. 3. Bamber's Ceara Pricker.

quarter should be ready for re-tapping. It is essential to prevent the incision from penetrating the cambium (see under *Plant Life*), otherwise a knotted condition of the stem will be produced, which will render tapping difficult, and if the cambium be much injured the life of the tree will be affected.

Coagulation.—The latex coagulates on exposure to the air, and that of some species coagulates much more rapidly than

others. The process is, however, usually accelerated by adding a few drops of acetic* or other acid, the rubber particles thus quickly forming a floating mass; heating the latex also hastens coagulation. The soft wet rubber is then separated from the remaining liquid (which is discarded), thoroughly washed by means of water with machine rollers, and then made up into the usual commercial forms, as *crepe* (Nos. 1 and 2), *blanket-crepe*, *sheet*, *block*, or *lace*. Until lately it was commonly made into biscuits, but this form is now too laborious to cope with the quantity turned out. *Smoked sheet* usually commands the highest price at present. *Smoking* is considered to have a preserving effect on all forms of rubber, and is applied, in the case of wild rubber, by exposing the latex on rollers over the smoke of palm kernels, the roll increasing in layers as fresh latex is poured on, while one man keeps twisting the roll round. Various estates have adopted different methods for treating the latex or rubber with smoke, but smoke-curing on plantations is at present in a transition or experiment stage.

Drying and Packing. Ordinarily about two months are required for the rubber to become quite dry and ready for packing for export, but with hot-air dryers and light airy drying sheds as are now used drying may be completed in a few days. In packing rubber, it should be laid perfectly flat, not bent or twisted. No packing material should be used with it, and the cases should be planed smooth on the inside.

RUBBER-PRODUCING TREES, SHRUBS, CLIMBERS, ETC.

Hevea (Para) Rubber. (*Hevea brasiliensis.* Euphorbiaceæ).—A quick growing, tall, erect tree, native of South America, introduced into tropical Asia in 1876, through the Royal Botanic Gardens of Kew, being first established at, and later distributed by, the Botanic Gardens of Ceylon and Singapore. About the year 1898 the cultivation of this and other rubber-producing trees received a great impetus, and has since made rapid strides in Ceylon, Malaya and most other tropical countries. Whereas in 1900 the export of rubber from Ceylon was 8,223 lb., of £859 in value, in 1913 it had increased to over 12,300 tons valued at about £4,084,600. The area under Hevea rubber at present in Ceylon is estimated approximately at 240,000 acres, and in Malaya at about 430,000 acres. Hevea, the most important of all rubber-producing

* PARKIN found from experiments that 1% glacial acetic acid to pure latex was sufficient for coagulation, but a somewhat larger percentage is usually allowed by planters.

species, thrives in any moderately good soil from sea-level to about 2,000 feet elevation, provided the rainfall is evenly distributed and not under 70 inches a year, with a minimum temperature of 60° to 70° Fah. The trees should be planted out (preferably as stumps or basket plants) at distances, in the first place, of not less than about 20 by 15 feet apart, say 140 trees to the acre; this will enable the plantation being thinned out later, on the merit of individual trees and irrespective of lines, to distances of about 20 by 25 feet

YOUNG PLANTATION OF HEVEA RUBBER IN CEYLON.

apart, leaving finally 90 to 100 trees to the acre, according to the soil and climate ; this is considered preferable to planting out at wide distances in the first place. Excessively close planting results in exclusion of light and air when the trees attain maturity, and therefore in slow and unsatisfactory renewal of bark over the tapping area. With good growth, the trees become tappable in fron 5 to 6 years, or when the stems have attained a girth of about 18 to 20 inches at 3 feet from the ground. (See *Tapping*.) The average

One of the first Hevea trees introduced into Ceylon, in Heneratgoda Gardens. Aged 39 years; yielded 375 lb. dry rubber in $3\frac{1}{2}$ years, 1909—1912 inclusive, and is still in bearing (1914); the tapping has been done by paring and confined each year to one-quarter the circumference of the stem.

annual yield of dried rubber may then be approximately ½ lb. per tree, increasing to 2 or 3 lb. per tree at 8 to 10 years old, and to an average of 4 to 6 lb. per tree when these are 12 to 14 years old. A return of 150 lb. of dried rubber per acre, from trees 6 years old, and 400 to 500 lb. at ten years old are considered good average yields, though in many cases a much larger crop is obtained. Ten trees on Culloden Estate, in Ceylon, about twenty-two years old gave an average yield of 18 lb. of dried rubber each in 1909, the range being from 13 to 25 lb. per tree. The trees increase in circumference of stem at an average rate of 3 to 4 inches per annum, and bear seed when 5 to 6 years old, producing from 2 to 3 thousand seeds at that age, to about 40 or 50 thousand when 18 years old (See below). The usual cost of bringing Hevea rubber into bearing, exclusive of cost of land, varies from about £20 to £30 per acre, according to the nature of the land and locality, while the cost of collecting and shipping the rubber ranges at present from 10*d.* to 1*s.* 5*d.* or more per lb. The price of rubber fluctuates considerably; that of *Fine Hard Para* rose from about 3*s.* 6*d.* to 9*s.* 4*d.* during 1909, reached 12*s.* 6*d.* in April 1910, with *Plantation smoked sheet* at 12*s.* 10*d.* per lb. *Fine Hard Para* is still the standard grade, but plantation rubber commands a higher price† and is now largely employed in the manufacture of tyres as well as for the finer uses. The seeds (see foregoing remarks) are large and oily, about 110 weighing a pound ; they are of short vitality, and germinate in about 10 to 12 days when fresh ; for transmission by post, 500 seeds with packing weigh about 9 lb.

Ceara Rubber. (*Manihot Glaziovii.* Euphorbiaceæ).—A small, rather spreading, quick-growing tree, 25 to 40 feet high, native of South America, introduced into Ceylon in 1877. By 1883 as many as 977 acres were reported to be under this tree in Ceylon, but, owing to difficulties of tapping the cultivation fell into neglect for a number of years. Lately, however, with a greater demand for rubber and with better methods of tapping, the trees yield a satisfactory return, and the rubber is second in quality only to that of *Hevea.* The tree is suited to a dryer climate and higher elevation than the latter, but unfortunately no perfect method of tapping it appears to have been yet devised. In Hawaii, where Ceara rubber is largely planted, the climate being unsuited to Hevea, the bark is stripped off perpendicularly in sections 6 in.

† At the time of writing, this has suffered a severe drop, the average London price being about 2*s.* 1*d.* per lb. as against 3*s.* 1*d.* for Fine Hard Para. (October 1913)

wide. In this area numerous incisions are made, the latex being allowed to run down to the base of the tree. A similar method is employed in German East Africa, where the tree is more or less extensively cultivated, and also in South America. Vertical incisions with the multiple pricking knife, without removing the outer bark, is considered by some the most satisfactory system of tapping for Manihots. The Manihot latex is remarkable for its readiness to coagulate without the addition of acid. The tree may be planted at closer distances than Hevea, and also tapped at an earlier age than the latter. Seeds of a hard horny

Manihot dichotoma plantation, 2 years old, in dry region, Ceylon, interplanted with *Crotolaria striata*, a green-manure crop.

character, retaining their vitality a long period; should be rasped at one or both ends before sowing (see under *Propagation*); about 720 seeds go to a pound. According to MR. H. POWELL, in the *Agricultural Journal of British East Africa*, for April, 1908, seeds at least a year old (from the time they fall from the trees) should be selected for propagation, fresh seed being "of slow and uncertain germination." The seeds are edible, having a pleasant nutty flavour.

Jequie Manicoba Rubber. (*Manihot dichotoma*).—A quick-growing species similar to, but rather smaller than, Ceara rubber, being distinct from the latter by the regular forking of the

branches. It is a native of South America, and has been introduced into Ceylon in 1907. The seeds are larger than, but not so hard as, those of Ceara rubber; at Peradeniya they germinated in a fortnight to three weeks, without filing or other artificial aid. The tree is adapted to a dry hot climate, thrives on a loamy soil, and is tappable at three to four years from planting, yielding its maximum return of rubber from the age of eight years onwards. In Brazil the trees are planted about 6 or 7 feet apart, say 1,000 to the acre, and a yield of about 1 lb. per tree is said to be obtained, but this requires confirmation. The trees are said to be tapped about twice a month only, for about 9 months in the year.

Remano Manicoba Rubber (*Manihot Piauhyensis*).—Another South American tree resembling the two former species, described as reaching a height of only 8 to 15 feet, the branches being forked two or three times. It has been introduced into Ceylon in 1908. The tree is found in the state of Piauhy, and grows best in a light sandy soil. Both this and the Jequie rubber are said to be superior to Ceara rubber in yield, but they have not been found satisfactory in Ceylon. The seeds are larger than those of the preceding species, and, being less hard and horny, germinate more readily.

Manihot heptaphylla.—Another species of Manicoba rubber, growing to about 20 to 25 feet in height, with dark-brown bark and purplish twigs. The seeds are larger and paler than those of Ceara rubber.

Central American, or Ule Rubber. (*Castilloa elastica.* Urticaceæ).—A tall quick-growing tree, with large oval leaves, native of Central America, introduced into Ceylon in 1876. It is propagated by the white, papery seeds, which are of the size of peas and of short vitality; it thrives best at medium elevations, with a rainfall of not less than 70 inches. The trees may be planted at the same distances apart as Hevea, say about 150 to the acre, thinning out afterwards to about 100 to the acre. They are tappable at six to seven years of age when the yield should be about 100 lb. per acre; at eight years old the yield may be 175 lb. per annum, and this should increase until at least the tree is about twelve years old, when it is estimated that a minimum of 2 lb. per tree a year should be obtained. Unlike Hevea and Manihot, the tree cannot be tapped at frequent intervals, the supply of latex becoming exhausted after each tapping. In quality, the rubber is considered to be next to Ceara rubber. High expectations have been formed of this tree in Trinidad and parts of South America, but these have not

RAMBONG RUBBER TREES (*Ficus elastica*), IN PERADENIYA GARDENS, CEYLON.

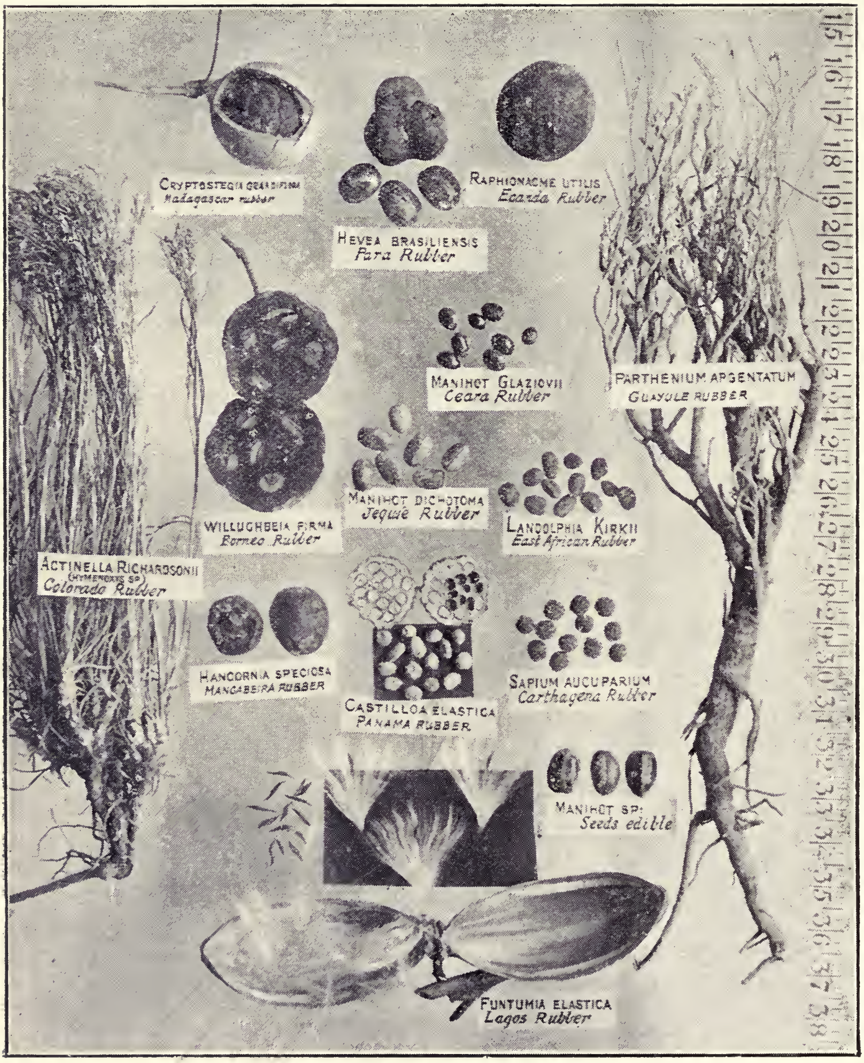
been warranted by results obtained in Ceylon, where the tree has ceased to be cultivated.

Lagos Rubber. (*Funtumia elastica.* Apocynaceæ).—A large, upright tree, native of West tropical Africa, Uganda, etc., introduced into Ceylon in 1897. Cultivation is much the same as for Hevea, but, like Castilloa, an interval of 3 or 4 weeks must elapse between each tapping; also like the latter, the latex takes a comparatively long time to coagulate. An annual yield of one pound or more per tree has been obtained from uncultivated trees in Uganda, and the quality of the rubber is but little inferior to that of Para rubber. The tree, however, takes longer than the latter to attain a tappable size. In Ceylon, a caterpillar pest regularly attacks and completely defoliates the branches. The seeds are small and grain-like, with a long silky appendage at the top end; they retain vitality well, and germinate readily in about fourteen days.

Rambong, Assam or India Rubber. (*Ficus elastica.* Urticaceæ).—A very large spreading tree, often with aerial roots developed downwards from the branches, or with enormous buttressed roots spread over the surface of the ground. The aerial or buttressed roots as well as the stems may be tapped for rubber, but the tree takes comparatively long to attain a tappable age; when at maturity, however, it yields large quantities of good rubber. The tree does not produce fertile seed in Ceylon, and has to be propagated by cuttings, which do not strike root readily.

Guayule, or Mexican Rubber (*Parthenium argentatum.* Compositæ).—A small slow-growing shrub, 2 to 4 feet high, indigenous to the deserts of Mexico. Of late years this came into prominence as a source of a low-grade rubber. Besides what is extracted locally, large quantities of the dried shrub have for some time been exported to Germany and the United States for the extraction of rubber, but the supply is limited and rapidly diminishing, and, with the present low price of rubber, will probably soon cease. The plant cannot be cultivated with profit, as it takes upwards of 20 years to come to maturity. In the process of rubber extraction, the whole shrub is pulled up and crushed between rollers. The plant contains no latex, but granules of rubber are scattered throughout the tissues. At one time it was cultivated in Malay, Java, etc., for rubber, but its cultivation has now been discontinued.

Ecanda, or Bitinga Rubber. (*Raphionacme utilis.* Asclepiadeæ).—A low stemless plant, bearing a large tuberous root, not



SEEDS, FRUITS, TUBERS, ETC., OF THE PRINCIPAL RUBBER PLANTS.

unlike a turnip in form, native of the treeless grass tracts or plateaus of Zambesi, British Central Africa, etc. It is found chiefly at elevations of 4,000 to 5,000 feet above sea-level, and is considered one of the most important of root-rubbers, the tuberous rhizomes containing a large percentage of rubber, which is extracted by rasping and boiling the rhizomes. Propagated by tubers. So far probably no one has succeeded in germinating seed of this plant outside its native country.

Jelutong.—A glutinous resinous substance obtained from the latex of species of *Dyera* (chiefly *D. costulata*) and *Alstonia*—large trees, indigenous to Borneo, Sumatra, and Malaya. To obtain the latex the trees are tapped, generally once a week, in a similar method to the tapping of Hevea, the latex being coagulated by adding a little kerosine oil, or sometimes other mixtures. A large tree is said to yield about 100 lb. of latex per annum. The latex contains about 10% of rubber, the rest being water, resin and other solids.

OTHER RUBBER-YIELDING PLANTS

[Many of these afford only a small proportion or an inferior quality of rubber].

Actinella Richardsonii. (*Apocynaceae*). Colorado Rubber.

Anodendron paniculata. (*Apocynaceae*). Large liane of Ceylon, India, etc.

Bleekrodea tonkinensis. (*Urticaceae*). Tonkin rubber. A sub-tropical tree of Cochin China.

Carpodinus lanceolata. (*Apocynaceae*). Root-rubber. African climber, with large tuberous roots.

Clitandra Henriquesiana. (*Apocynaceae*). Root-rubber. An erect shrub of Central Africa.

Cryptostegia grandiflora. (*Asclepiadeae*). An ornamental climber, native of tropical Africa; commonly grown in gardens for its large showy pink flowers.

Cryptostegia madagascariensis. "Lombiri" or Madagascar rubber.

Ecdysanthera glandulifera. (*Apocynaceae*). A climber of Cambodia.

Eucomia ulmoides. Chinese Rubber. A bushy tree of China, suited to a cool or temperate climate.

Euphorbia rhipsaloides. (*Euphorbiaceae*). "Almeidina" or "Potato-gum." A kind of rubber obtained from a small succulent tree in Portuguese East Africa, whence it is exported; it fetches 6*d* to 9*d* per lb. in London (March 1913).

Ficus Vogleii. (*Urticaceae*). West African, Congo or Memleku Rubber. A medium-sized tree, introduced at Peradeniya in 1881.

Forsteronia floribunda. (*Apocynaceae*). "Milk-vine" of Jamaica.

F.—gracilis. A liane of British Guiana.

Hancornia speciosa. (*Apocynaceae*). Mangabeira Rubber. Small shrubby tree; fruit edible, seed of short vitality.

Landolphia florida. (*Apocynaceae*). Mozambique Rubber.
L.—Kirkii. Zanzibar Rubber.
L.—owariensis. Congo or Sierra-Leone Rubber.
L.—Petersiana. East African Rubber.
} Large African lianes.

L.—ugandensis. Nandi Rubber. A vine found in B. E. Africa, at elevations of 6,000 to 7,000 ft. Tapping is effected by shaving off slices of bark, the latex being coagulated by smearing salt water on the surface, also by chewing.

Leuconotis elastica. (*Apocynaceae*). Borneo.

Mascarenhasia elastica. (*Apocynaceae*). "Hazondrano." A tree 50 to 60 ft. high, with slender branches, native of Madagascar and East Africa; introduced at Peradeniya in 1902. The trunk usually branches low down ; leaves opposite, coriaceous. Adapted to swampy ground.

Parameria glandulifera. (*Apocynaceae*). Talaing milk-creeper. A Malayan liane.

Plumeria acutifolia and P. rubra. (*Apocynaceae*). Respectively white-and red-flowered Temple-trees, both indigenous to tropical America. They yield a quantity of white latex which, though resinous, is used in Mexico for the extraction of rubber. See *Flowering Trees*.

Sapiun Jenmani. (*Euphorbiaceae*). Large trees yielding the "Carthagena rubber" of Colombia and "Tonckpong Rubber" of British Guiana.

S.—Thomsoni. Virgen Rubber ; also a native of Colombia.

Tabernamontana Crassa. (*Apocynaceae*). Medium-sized tree, native of Central Africa.

Ureceola elastica. (*Apocynaceae*). A climber of Burma.

Willughbeia firma. (*Apocynaceae*). Borneo rubber. A large liane of Borneo, etc.

Tea ; Thay-gas, *S.;* Téy-ilé, *T.*—The tea of commerce consists of the cured young leaves and tender tips of shrubs belonging, according to Sir Geo. Watt, to either of two distinct varieties or races of *Camellia Thea*,—viz., Camellia Thea variety *Viridis* and C. T. variety *Bohea*. To variety *Viridis*, a native of North-eastern India, is considered to be traceable the races "Assam Indigenous" and "Manipur," as well as many other cultivated varieties widely planted in India, Ceylon, and Java. The China Tea (variety *Bohea*) is distinguished by its squat straggling habit and comparatively thick leaves ; it is the Tea plant chiefly grown in South China, and is cultivated on some of the higher estates in Ceylon, being hardier than, but not so productive as, the Indian kinds named. The "Assam Hybrid" is considered to be a natural hybrid between the "Assam" and "China" teas. Left to itself, the Assam Tea is an erect tree, 30 to 40 feet high, but in cultivation it is "topped" early and kept as a bush, not being allowed to grow higher than about 4 ft. Tea has been cultivated from time immemorial in China and Japan. Its cultivation in Ceylon on a commercial scale may be said to date from 1867, although the

A TEA FIELD, WITH PLUCKERS AT WORK, IN CEYLON.

earliest record of its introduction to the Botanic Gardens goes as far back as 1839 for Assam Tea, and to 1824 for China Tea. Tea is now extensively grown in Southern India, Bengal, Assam, Java and Ceylon. In the latter country it is the principal planting product; here the export rose from 23 lb. in 1873 to about 192 million lb. in 1913, and about 400,000 acres are now under the product. China is considered to be the largest tea-producing country, though the bulk of its production is consumed locally. In recent years, tea has been successfully cultivated in Natal and Nyasaland. The tea plant, more especially the Assam Tea, is adaptable to a wide range of temperature and various conditions of soils, provided the rainfall is not less than about 70 inches and is evenly distributed; in Ceylon it thrives from sea-level to over 6,000 ft. It will not, however, flourish in a dry climate, especially at low elevations. The soil must be well drained and should contain a certain amount of humus: when the latter is deficient it should be supplied by means of green-manuring, as by inter-planting quick-growing leguminous trees or shrubs which can be lopped frequently, the twigs and leaves being left on the ground to form a mulch, or preferably dug in. Manuring periodically by artificial or cattle manure is necessary in order to maintain the crop in a remunerative condition. Tea seed is usually sold by the maund (80 lb.). A maund may contain 2,000 or more seeds, according to the jat (the better the jat the heavier the seed), and this should give about 15,000 plants. "Planted at 4 by 4 ft. apart, a maund of seed should be sufficient for 3½ acres; at 5 by 4 ft., 4½ acres; and at 5 by 5 ft., 5¼ acres." (RUTHERFORD'S Note-book).

Propagation is entirely by seed, which may be sown in raised nursery beds, at distances of 4 inches apart each way, the beds being shaded by fern fronds or Grevillea leaves fixed in the ground slanting-wise. It is best, however, to raise plants in small plant-baskets or bamboo joints. In about ten months from the time of sowing, the seedlings should be ready for planting out in the field. Holes being made in lines, the plants are set out at distances of about 4 ft. by 4 ft. or 5 by 4 ft. apart, being shaded, and watered when necessary, until well established. About eighteen months after planting, the plants are "topped" (i.e. cut back to 12 or 15 inches from the ground) so as to induce a spreading bush. The first crop of leaf is obtained in the third year in the low-country, it being a year or so later at higher elevations. At low elevations plucking takes place about every ten days, and

at the higher altitudes once a fortnight or three weeks, according to elevation. When the bushes stop flushing, they are pruned back severely, this being necessary at intervals of about fifteen to eighteen months in the low-country, or of three to four years up-country. When in full bearing at seven or eight years old, the crop of made tea may, according to elevation, soil, and degree of cultivation, be from about 400 lb. to over 1,000* lb. or more per acre; 600 lb. is considered a good average yield. The tea plant lives to a great age. The oldest tea in cultivation in Ceylon is over fifty years of age, and shows no lack of vigour. *Plucking*, which is usually done by women or boys, consists in nipping off by hand the tender end leaves with the bud and shoot; taking two leaves and end bud constitutes *fine* plucking and affords a good quality tea, while three or four leaves and a bud forms *coarse* plucking and yields tea of a lower quality. Pluckers will pluck from 20 to over 80 lb. of green leaf a day, according to the condition of the field and the activity of the workers. The leaf being brought to the factory, it is *withered* on tiers of hessian screens in drying sheds, through which hot air is driven; it is then *rolled* by means of rolling machines (during which the process of *fermentation* takes place), being followed by *firing* in drying machines, and finally *sifted*. By the latter process the tea is simultaneously *graded* into such qualities as "souchong," "pekoe souchong," "orange pekoe," "broken orange pekoe (the best quality)," and "dust." It is then packed into lead-lined square cases or chests of uniform sizes for export. A full-size chest contains 80 to 100 lb.; a ½ chest, 40 to 50 lb. Black or ordinary tea has been exported from Ceylon in 1913 to the extent of nearly 186¼ million lb., valued at over £5,852,600.

Green Tea.—This is made by subjecting the green leaf at once to a process of steaming in a revolving cylinder, and afterwards by rolling, drying, etc., the process of withering and rolling being omitted. China teas are usually made on this principle. There is a certain demand for green teas in some countries, notably the United States, and Ceylon now manufactures and exports a considerable quantity to meet this demand. In 1912 the export† of green tea was over 8,093,000 lb., valued at £ 23,550.

Brick Tea.—A cheap and coarse tea, made in China and used largely in Tibet, being boiled with salt, butter, etc. Brick or tablet-tea is made in two forms, one of which consists practically

*On Mariawatte Estate, Gampola, Ceylon, a field of over 100 acres has given an average per acre of 1,357 lb. for seventeen years. †Being somewhat less in 1913

of twigs and leaves of tea, pressed with some glutinous substance, and dried in moulds; the other kind is essentially the finer siftings and dust of ordinary tea compressed into slabs; this latter is consumed chiefly in Russia.

Leppet or Leptet Tea.—A form of tea prepared only in Burma and the Shan States, where it is used as a vegetable rather than a beverage. It consists of tea leaves preserved on the principle of a silo, these being afterwards eaten mixed with garlic, salt, oil and other ingredients.

Soluble Tea. A process has in recent years been invented by MR. KELWAY BAMBER, the Ceylon Government Chemist, by which the essence of tea is extracted and rendered available in a concentrated soluble fine powder form, known as soluble tea.

Arabian Tea.
Ayapana Tea.
Paraguay Tea, or Maté.
} See Chapter XXIV.

Tobacco; Dhoom-kola, *S*; Poyilé, *T*.—The dried cured leaves of *Nicotiana Tabaccum* and *N. rustica* (or varieties of these), both of South American origin, may be said to constitute the tobacco of commerce. The cultivated tobacco plant is an erect annual, 4 to 6 ft. or more in height, bearing large lanceolate alternate leaves, and characterized by viscous glandular hairs. The principal tobacco-growing countries are Cuba, Sumatra, South America, Philippines, Borneo, India, Turkey, and South Africa. Tobacco-growing forms a local industry in the North of Ceylon, the produce being largely used for chewing with betel and for making inferior cheroots, being also exported to a limited extent to South India. Nearly 4½ million pounds have been exported from Ceylon in 1913. The best soil for tobacco is considered to be alluvial or light sandy loam, rich in potash, lime and humus; clayey or calcareous soil is unsuitable. A hot humid climate favours the growth and the development of the special properties of the plant, but a dry season must be relied upon for harvesting. Tobacco is a very exhausting crop, so that manuring is essential. Cattle or other organic manure when obtainable is considered by some to be the best, at least for certain forms of manufacture, while for other forms it is said to be injurious. The crop is an annual one, the plants being raised from seed* (which is small and should be sown under cover), and planted out in the field at intervals of about 2 ft. in rows, the latter being 4 ft. apart. The young tender plants must be shaded

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* 1 oz. contains about 875,000 seeds.

with small branches or fern-fronds (and watered if the weather be dry) until well established, after which no shade is required. In five to six weeks from planting, the flower buds will appear at the top of the plants ; these as well as any side-buds must be nipped off, the operation being known as *suckering* or *disbudding*. Such buds must be repeatedly removed as they appear, so as to divert the vigour of the plant to the leaves.

Harvesting. About six weeks later, or three months from the germination of the seed, the leaves should be ripe for

TOBACCO FIELD IN JAFFNA, CEYLON.

cutting, this being indicated by their turning a yellowish green, with the appearance of brown spots and the edges and tips curling downwards. Cutting should not be done when rain is on the plant, nor when the sun is at its hottest. There are several methods of harvesting. In some cases the whole plant is cut within 3 or 4 inches of the ground, in others the leaves are cut separately as they ripen, from the bottom upwards, which is obviously the more rational method.

Withering.—The leaves being carried to the drying shed, they are first spread on the floor to wilt, then tied in bundles of

25 to 30 and strung on poles to dry gradually. Drying or withering takes about 3 weeks, and may be decided by the softness of the mid-rib of the leaf. The process renders the leaves soft and pliable, and prevents their being broken when handled.

Fermenting or Curing, a most important process, follows, and upon this depends the proper development of the peculiar narcotic principle of tobacco. When sufficiently dry, the leaves (which are sorted according to quality into hands, usually of about 14 leaves each) are placed in heaps on a concrete or wooden floor to ferment, being laid out in double rows with all the tips towards the centre and overlapping. The heaps are then pressed down by weights and turned over at intervals to equalize, and prevent excessive, fermentation. Complete curing takes from 8 to 12 weeks, after which the leaves will have acquired the qualities of tobacco.

Grading the leaves is a very important matter, and is dependent upon their size, colour, aroma, texture, etc., the chief object being to obtain grades of as uniform a character as possible. There are a number of distinct types of tobacco leaf recognised by experts, each of which is adapted to definite trade requirements. It is said that even the crop from the same field can sometimes be sorted by an expert into as many as seventy different grades. The various well-recognised forms are, however, usually associated with variations in soil and climatic conditions under which the crop is grown, and also with different methods of production. Thus certain districts are known to possess certain qualities which adapt them to definite purposes.

Yield—Each plant should yield about 8 marketable leaves on an average. In India and Ceylon a good average field gives 30 to 40 maunds of cured leaf per acre, and the price usually obtained varies from about Rs. 5 per maund upwards. A maund (80 lb.) equals about 1,000 leaves.

CHAPTER XXIII

MINOR PRODUCTS OF CEYLON

[S=SINHALESE; T=TAMIL]

Annatto or Arnatto. (*Bixa Orellana.* Bixaceæ). A large, quick-growing shrub or small tree, native of tropical America, thriving in Ceylon from sea-level to 2,000 feet in the moist region. It bears at the ends of the branches clusters of brown or dark crimson capsular fruits (covered with fleshy spines), which contain a number of small seeds. The bright crimson covering of the latter affords the annatto dye of commerce. The fruits are collected when nearly ripe, and as the shells dry they open and disperse the seeds, which are then either made into annatto "paste," or dried with their covering when they are marketed as annatto "seed." Formerly the paste form was preferred by manufacturers, but the demand for this has now much declined in favour of the dried seed. The amount of annatto seed imported into England is said to be from 75 to 100 tons a year; the price fluctuates from about 2½d to 5d per lb., according to quality and demand. Small plantations of Annatto have been made in Ceylon, chiefly in the Matale district, and at one time a considerable quantity of the seed was exported; now, however, very little is exported, but the seed is sometimes used locally for dyeing. The export of Annatto seed from Ceylon in 1909 was 263 cwt., valued at £307; but the Customs give no figures for 1912. The tree is readily propagated from seed, and a crop may be obtained from the third or fourth year. Two varieties of the tree occur in Ceylon, these differing chiefly in the shape and colour of the fruit, which in one case is oblong and pointed, and in the other rather circular.

Areca-nut, or Betel-nut; "Puwak." S; "Pák-ku," T; "Pan" [*Hind.*]; (*Areca Catechu.* Palmæ). A tall, slender, erect palm, 40 to 50 feet high, with a thin cylindrical straight stem, native of Malaya, but naturalised in Ceylon. It is extensively cultivated throughout tropical Asia for its "nuts" (seeds), which in the husk are usually of the size and form of a hen's egg, being yellow or orange-yellow when

ripe. The brown conical nut (seed) is commonly used throughout Ceylon, India, Malaya, &c., as a masticatory. In preparing the latter, a few thin slices of the nut are taken, to which is added a dash of lime-paste, some tobacco-leaf, cardamom or other spice; all is then made up in a pellet with the leaf of the betel-vine (see under *Betel*). Large quantities of arecanuts are thus consumed annually throughout Asia. Arecanuts are also commonly used for destroying worms in dogs, in the preparation of dentifrices, and for

ARECANUT PALMS. *Areca Catechu.*
SHOWING COOLIES CLIMBING FOR THE "NUTS."

tanning. The local consumption of the nut is very large, and a considerable quantity is exported, chiefly to South India. The quantity now exported from the Island is about 7,480 tons a year, valued at about £185,560. Arecanuts are sold in London at 18*s* to 22*s* per cwt. Very large quantities are produced in South India, Sumatra, Malaya, etc. In Ceylon, the arecanut palm thrives in the moist low-country up to 3,000 ft., and requires but little care in cultivation when well established. It takes six to seven years to come into bearing, and

at maturity an average yield of 250 to 350 "nuts" per year may be obtained from each tree. The trees continue productive for 20 to 30 years, but may live unproductive for many years longer. At 5 by 5 ft. apart, 1,742 may be planted to an acre, the crop from which, estimated at an average of 29 cents per tree, should be worth about Rs. 340 (say £23). The area under Arecanuts in Ceylon is estimated to be equivalent to about 70,000 acres. The palm is frequently planted in Ceylon as boundary lines, for which it is well adapted.

BETEL-VINE CULTIVATION IN CEYLON.

Betel-leaf; Bulath-vel, *S.*; Veth-thilé, *T.* (*Piper Belle.* Piperaceæ).—A perennial evergreen climber or creeper, with large heart-shaped leaves, indigenous to Ceylon, India and Malaya, cultivated throughout tropical Asia for the sake of the leaves. The latter are universally used in the East for chewing, in a green state, in the masticatory commonly known as "betel," the other constituents of which are a dash of lime and a few slices of arecanut (see above). The leaves have a sharp pungent taste, and when chewed are considered to have sustaining properties. Sir Emerson Tennent expressed the opinion that the habit of

CAMPHOR CULTIVATION IN CEYLON, AT 4,500 FT. ELEVATION.

betel-chewing is "advantageous to a people of whose ordinary food flesh forms no part, and that it is at once the antacid, the tonic, and the carminative which they require." The plants require a rich humus moist soil and a partially shaded situation. They are readily propagated by cuttings, which are planted against poles, trellises or tree trunks for supports. In Bengal and Northern India, the plant is cultivated in low sheds or "betel houses."

VARIETIES.—In addition to the ordinary type, the following varieties are known in Ceylon: "Rata bulath-vel" or "Siribo bulath;" "Naga walli-bulath" (with variegated leaves), and "Getatodu bulath."

Camphor; Kapuru-gas, *S.* (*Cinnamomum Camphora.* Lauraceæ).—A moderate sized much-branched tree, native of Formosa, Southern China and Japan, yielding by distillation of the wood, twigs, leaves or roots the camphor of commerce. Camphor is used largely in the manufacture of celluloid, zylonite, smokeless gun-powder, and in the preparation of disinfectants and medicines. The world's supply at present (approximately 5,180 tons) comes almost entirely from Formosa. The tree, however, is commonly cultivated in Japan and S. China. Grown for seed, it takes 20 years to become fruitful. The season for the seed is in November. In recent years, Camphor cultivation was introduced into Ceylon, South India, California and Hawaii. The Camphor tree, however, has been established at Peradeniya since 1852. In 1893, experiments were begun at Hakgala Gardens, Ceylon, in the systematic cultivation of the product, plants being raised from seed imported from Japan for distribution to the planters. The tree, though naturally a sub-tropical one, is adapted to a wide range of climate and soils. In Ceylon it has been found to grow well under varying conditions of climate, as at Galle, Anuradhapura, and Peradeniya; but the most uniform and vigorous growth occurs at the higher elevations, as at Hakgala, on fairly good and well-drained soil. Some Camphor plantations have been successfully established in Ceylon in recent years at elevations of from 3,000 to 5,000 feet, but the slump in the price of the product has rendered the cultivation unprofitable. Here also the tree is sometimes planted as a wind-belt, for which it is well adapted. About 1,000 acres were estimated to be under Camphor in Ceylon in 1908, the export for that year being nearly 15 cwt., valued at Rs. 3,075. In cultivation, the trees have to be coppiced to a height of about 4 to 5 feet, in order to obtain successive clippings; therefore they may be planted at distances of about 6 ft. apart each way, giving about 1,210 trees per acre; in the third or fourth year they

are fit for *clipping*, the shoots being cut with a knife or hedgeshears. The clippings on distillation usually give a yield of 1% to 1·50% of pure camphor, in addition to about 30 per cent. of camphor oil. The bushes may be clipped three or four times a year. Mr. W. Nock estimated that an average of 14 lb. of clippings a year may be obtained from each tree at Hakgala Gardens, which should give at least 170 lb. of camphor per acre. In Formosa the annual yield is estimated at 120 lb. per acre; while in the United States a yield of 200 lb. is said to be ordinarily obtained. Bamber estimated 170 to 200 lb. to be about the average yield in Ceylon, being obtained from 20,000 lb. of fresh loppings, in 3 to 4 clippings a year. Fair average camphor commanded £20 per cwt. in 1907; to-day (1913) it fetches only about £7 to £8 per cwt. Left to itself, the tree grows to a height of 9 to 12 feet in five years, attaining in time a height of at least 30 to 40 feet. It is best propagated from seed, which take about 3 months to germinate, and have often a low percentage of germination; if sown quite fresh, however, about 2,000 plants may be obtained from a pound of good seed. The tree may also be raised by root-cuttings, but branch-cuttings are difficult to strike root. Seedling plants should be large enough in 8 months for planting out.

Distillation.—The camphor is obtained by steam distillation of the clippings, wood, or roots, and the process is briefly described thus:—

The vapour is condensed in a box, divided into compartments and placed upside down, in water in a larger, shallower box. The sides of the inverted box extend above the bottom, and water is constantly allowed to run on to this box, keeping it cool and renewing the layer of water in the larger, shallower box which acts as a seal. A third box is inverted over the first, and is made in a similar way to condense any vapour that may escape; in both cases holes are made in opposite corners of the partitions in the boxes in order to cause the vapours to travel by a circuitous route. The crude camphor and oil are skimmed from the surface of the water or scraped from the sides of the condenser; separation of the two products is effected as far as possible by pressure.

Synthetic Camphor.—A compound prepared from oil of turpentine, the introduction of which has probably contributed to the considerable drop in the price of natural camphor within recent years, viz., from £20 to about £7 per cwt., as already referred to.

Borneo or Sumatra Camphor (*Dryobalanops aromatica*. Dipterocarpeæ).—A large tree, yielding a variety of camphor, or a camphor-like resin, which is obtained from the trunk and forms an

important article of commerce in China and Japan, but is not imported into Europe. It is said to be preferred by the Chinese to the ordinary camphor.

Nagai Camphor (*Blumea balsamifera.* Compositæ).—A perennial shrubby plant, native of Borneo. The leaves when bruised smell strongly of camphor, and are used medicinally by the Natives.

Cassava. See *Tropical Vegetables and Food Products.*

Cinchona, Peruvian or Quinine Bark.—Quinine and the allied alkaloids, *cinchonine, cinchonidine and quinidine,* consist of the active principle of the bark of several species of *Cinchona,*—small upright trees, 25 to 40 feet high, all natives of the mountains of Bolivia, Peru and other parts of South America. The principal species affording the valuable bark are *Cinchona Succirubra* (Red-bark), *C. officinalis* (Crown bark), *C. Calisaya* (Yellow-bark), and *C. Ledgeriana* (Ledger's-bark); the last named is considered the richest in quinine, and is the one chiefly grown in the Government Cinchona plantation in Bengal. To these may be added several superior hybrids. The valuable curative effect of quinine in malarial fevers were first made known in 1638, when the drug was administered to the Countess of Cinchon, wife of the then Viceroy of Peru, after whom the plant was named. Cinchona was introduced at Peradeniya in 1861, but not until about 1870 were the Ceylon Planters induced to take up its cultivation, the Government first establishing nurseries of Cinchona at Hakgala Gardens, and issuing plants free of charge. The area under Cinchona, however, rose from 500 acres in 1872 to 64,000 acres in 1883, the export of bark at its maximum extent (1887) being nearly 16,000,000 lb. The result was great over-production and consequently a fall in the price of the commercial drug from 15*s.* to 1*s.* 3*d.* per oz.—an immense boon to the public, though a disaster to many planters. At the present time the area under Cinchona in Ceylon is only about the equivalent of 190 acres; the export of the bark in 1912 was 111,918 lb. valued at £299. Cinchona cultivation is still carried on profitably in Java, now the chief producing country, where quinine sulphate is locally manufactured; also on plantations at Mungpoo and elsewhere in India, which are worked by Government for the benefit of the peasants, to whom the article is supplied in small pice packets.

The plant thrives best in a rich humous soil with a porous subsoil, preferring a cool mountainous climate (4,000 to 6,000 ft.), with a moderate rainfall and shelter from strong winds.

C. succirubra is, however, an exception, and thrives best between 2,000 and 4,000 ft. The plants may be propagated by cuttings, layering, or from seed, the latter method being usually adopted. The seed is very minute, and should be sown thinly in boxes or on raised nursery beds under cover, finely sifted soil being sprinkled over the surface and the whole carefully watered with a fine rose. In about three weeks the seedlings will be up, and when 2 inches high these should be transplanted to a well-prepared nursery plot so as to harden them off, the shade being reduced gradually; when 8 to 9 inches high, they may be planted out in their permanent places. The proper distances for planting vary according to the variety grown and locality. Close planting (4 ft. by 4 ft.) at first, and gradually thinning out later until only half the number of original trees are left, is considered preferable to the wide planting formerly adopted, viz., 12 by 12 ft. The uprooted trees afford a return, the bark being stripped from their stem and roots. Root-bark is considered the most valuable.

To obtain the bark from the standing trees, four different methods are employed: (1) *lopping*, by which the branches are lopped, and the bark removed from these in longitudinal strips; (2) *coppicing*, the trees being cut down to the ground when about 6 years old, and the stems barked; this induces the production of upright shoots, which in turn are cut down and barked; (3) *shaving* the stem by means of a spoke-shave, care being taken not to reach the cambium; only two sides of a tree are shaved at once; (4) *mossing*,—the bark of trees seven or eight years old is removed in alternate strips 1½ in. wide, the stem being protected by a covering of moss tied on; thus in about two years the renewed bark, which is richer in quinine than the first bark, is again ready for removal. The peeled bark is dried gradually in the sun, and exported in bales, the various forms being kept separate, as "root-bark," "flat-bark," "quill-bark," and "shavings." 600 lb. of dry bark per acre a year, or 2 lb. per tree (at seven years old), is considered a good average yield.

Citronella-Grass; Pangiri-mana, *S. Cymbopogon* (*Andropogon*) *Nardus*. A large coarse grass, 3 to 4 ft. high, cultivated in Ceylon (and of late years in Java) for its essential oil, which is obtained from the leaves by distillation. The grass grows in any ordinary soil, and thrives best in a hot and moist climate. It flourishes up to 2,000 ft. elevation, but its cultivation in Ceylon is confined to the sea-coast in the South-west part of the island, where approximately

30,000 acres are under the product. The grass is readily propagated by root division (seed being rarely produced), and may be planted about 2 by 3 ft. apart, in rows. Permanent shade is unnecessary, and the mode of cultivation is very simple, weeding being the chief requirement. It is recommended to replant the grass about every five years. The clumps are ready for cutting in about eight months from time of planting. Two cuttings a year may be obtained, and about 40 lb. of marketable oil per acre is estimated to be an average annual yield. The oil has a strong aromatic odour, and is exported for use in scented soaps, perfumery, etc.; it is also an excellent preventive against mosquitoes and leech bites. Owing, however, to overproduction and the fall in the price of the oil (the present price being about 1*s.* per lb.), this industry has considerably declined in recent years. The export of oil from Ceylon in 1912 was about 1½ million pounds, valued at £79,500.

VARIETIES.—In Ceylon there are two varieties cultivated, "Maha-pangiri" or "Winter's Grass" and "Lenabatu-pangiri;" the former, with broader leaves, is considered to give the larger yield and better quality of oil. A distinct variety with broad drooping leaves, introduced by BAMBER from Java, is known at Peradeniya as "Java Mahapangiri."

Lemon Grass; "Seyra," S. (*Cymbopogon* (*Andropogon*) *citratus*). A grass resembling the former kind, cultivated for the production of Lemon-grass oil. The latter commands a higher price than Citronella oil, but the demand for it is limited. The plant may be grown successfully up to about 2,000 ft., and has given an annual yield of 20 lb. refined oil per acre at the Peradeniya Experiment Station (1,600 ft.). Propagation is by division of mature clumps, and general cultivation is the same as for Citronella grass. The oil is used for scenting fine soaps, blending scents, and for similar purposes. The yield varies with soil and climate; but usually, with two crops a year, the return per acre is considered to amount to about 5,000 bundles (each 6 in. diameter), capable of yielding at least 100 quarts of oil. Refined lemon-grass oil sells in Europe for at least 6*d.* per oz. As a quart contains forty fluid ounces, the product of an acre should thus realize a value of £100.

VARIETIES, Etc.—C. flexuosus, known as Malabar or Cochin grass, furnishes the Lemon-grass oil of Malabar, supposed to be superior to C. citratus. See *Oils*.

Coca, or Cocaine-plant. (*Erythroxylon Coca.* Linaceae).—A small shrub, 6 to 8 feet high, indigenous to Peru and Bolivia, being found at elevations of 4,000 to 6,000 ft., introduced into Ceylon in 1870. It is extensively cultivated in its native habitat, where the

dried leaves (from which cocaine is obtained) are exported to the extent of about 800 to 900 tons a year, chiefly to Germany and the United States. The plant thrives best at elevations of 1,000 to 3,000 ft. in Ceylon, where small areas have been successfully established, the dried leaves being regularly exported. The best conditions for cultivation are a rainfall not under 70 inches, good friable soil (preferably that of virgin forest), and land of a gentle slope. Good natural drainage is important, and shade is essential until the plants are well established, but not afterwards. The seed must be sown fresh, preferably under cover and in baskets, the seedlings

COCA, OR COCAINE PLANT (*Erythroxylon Coca*), IN CEYLON.

being afterwards planted out at distances of about 4 by 4 ft. apart. In South America, a method sometimes adopted in the raising of seedlings is to throw the seed when fresh in a heap, thus setting up fermentation and inducing germination; in other cases they are sown in rows *in situ*, the ground being then covered with grass-litter or leaves, the seedlings being afterwards thinned out as desired. The first picking of leaves may be obtained at about 18 months from the time of planting, or at 2½ years from seed. Several pluckings are made in the year, the mature leaves only

being selected as far as practicable. These are best dried in the shade, so as to retain their green colour as much as possible. Sun-dried leaves are considered to contain less cocaine. The dried leaves are best packed for export in zinc-lined air-tight cases, as any moisture or sweating is injurious to them. On some plantations, however, the bushes are clipped with shears, and the dried twigs with leaves made up in pressed bales for export. A return of about 1,200 to 2,000 lb. of dried leaf per acre per annum may be obtained.

The chief use of the plant is for the extraction of cocaine from the leaves. In its native home the leaves are very largely used as a masticatory, being chewed with a little unslaked lime; the immediate effect is said to be a "gentle excitement, with sensations of high enjoyment, lessening the desire for food, and enabling the chewer to undergo an enormous amount of fatigue." The leaves are also sometimes infused as tea, the infusion being taken as a drink. Since the restrictions on opium consumption in India, large quantities of cocaine are frequently smuggled into that country for use as a substitute for opium. The value of the dried leaves, though said to be largely judged by appearance, depends upon the amount of alkaloid they contain. DR. DE JONG estimated that in Java 1,125 lb. of dry leaf yields about 7 lb. of alkaloid (=1·5 per cent.), from which 13½ lb. pure cocaine can be obtained. The price obtained for the leaf fluctuates considerably. In Colombo it varies from about 30 to 45 cts. per lb. (=say 5*d.* to 7½*d.*), and in London from 6*d.* to 10*d.* per lb., according to quality of leaf and demand. The export of Coca leaves from Ceylon in 1911 was 1,432 cwt. valued at £ 4,654; but in 1912 the figures dropped to 1,186 lb. valued at £ 3,838.

VARIETIES.—The plant occurs under two distinct types (of which there are different forms), distinguished chiefly by the leaves, viz. (1) var. *novagranatense*(=Huanaco or Bolivian Coca), characterized by pale-green leaves and a free bushy habit, producing a good quantity of leaves; (2) var. *truxillense* (=Peruvian type), with narrower and darker leaves. The former is the one chiefly grown in Ceylon, and is more esteemed in commerce, being known as Ceylon-Huanaco. Var. *spruceanum*, which closely resembles var. *truxillense*, is said to be the one chiefly grown in Java.

Coffee. "Kopai," *S. & T.*—The coffee of commerce is furnished by *Coffea arabica*, known as "Arabian coffee," and to a small extent by allied species or varieties (see below). *Coffea arabica* is a small slender tree, native of tropical Africa, but introduced into all tropical countries and cultivated extensively in

Brazil, West Indies, South India, Java, etc. According to the late Dr. Trimen the Arabian Coffee was first introduced into Ceylon in 1690, by Arabian traders. Coffee cultivation in Ceylon may be said to have first begun, on an important scale, in 1825, when Ganaroowa Estate (now Government Experiment Station) was opened as the first upland plantation. In 1869 a serious fungus disease (*Hemeleia vastatrix*), known as the "Coffee-leaf disease," appeared, and spread with alarming rapidity until in a few years it devastated the whole industry and ruined many planters. The export from Ceylon consequently dropped from nearly one million

FIELD OF ARABIAN COFFEE, UNDER SHADE, IN NILGIRIS, S. INDIA.

cwt. in 1874 to 1,040 cwt. in 1909, and to 156 cwt. in 1912 valued at about £566. Now, however, with better prices and larger yields obtainable (especially from *C. robusta*), the prospects of Coffee cultivation in Ceylon are improving, more particularly as a catch- or intercrop with Rubber, Coconuts, etc., and at present about 900 acres are under the product.

Coffee requires a moderately humid atmosphere, and prefers deep loamy and well-drained soil; it is unsuited to stiff clayey or poor sandy soils. The most suitable climate for the Arabian coffee

is at elevations between 2,000 to 4,500 ft., while the Liberian coffee is best suited to elevations below 2,000 ft. Propagation is by seed sown in nursery beds or, preferably, in baskets or bamboo-pots. The seed germinates in about six weeks, and the seedlings should be ready for planting out in about eight to ten months. In planting out in the field, the plants are set in lines, the distances apart being about 6 ft. each way for the Arabian kind, and 8 to 10 ft. for the Liberian. Temporary shade must be afforded until the plants are established, permanent shade being usually considered unnecessary, except at low elevations. In South India, however, Coffee is usually grown under permanent shade trees. Manuring periodically is indispensable, and farmyard manure when obtainable is considered the best. Pruning is effected mainly to keep the trees in shape, thinning out superfluous or useless branches. The bushes blossom chiefly in March or April, the following crop being harvested in October and February. The first crop is obtained when the plants are four to five years old. When in full bearing, a yield of about 1 lb. dried coffee per tree, or 6 to 7 cwt. per acre, is considered a good average crop, though under favourable conditions a much larger yield is obtained. In South America the average annual yield is said to be about 8 cwt. per acre. The berries are picked when they turn red, and a good worker can pick three bushels a day. A bushel of berries will yield about 10 lb. of dry coffee. Arabian coffee is at present quoted in London at 75*s*. to 80*s*. per cwt.

Pulping (i.e., removing the shell or pulp of the berries) is done by a pulping machine; or it may also be done by pounding the berries in a mortar. Each berry contains two seed ("beans"), with their flat sides facing each other. The mucilaginous substance surrounding these is removed by fermentation, afterwards washing the beans in water, after which they are dried in the sun. The "beans" are then known as *parchment* or *plantation coffee*. The parchment or thin shell of the seed is removed by "hulling" machines or by pounding the seed in wooden mortars. A bushel of parchment coffee will only give about half that quantity of clean beans. The coffee is then put through a winnowing mill to separate the chaff or broken parchment, etc. Sometimes the berries are simply dried whole, being then known as *native Coffee* or *dry berry*. In this form the quality of the coffee is said to be superior, but the pulping and subsequent processes are more troublesome, and transport is more costly.

OTHER KINDS OF COFFEE

Liberian Coffee. (*Coffea liberica*).—A robust-growing species, native of West Tropical Africa, and introduced into Ceylon about 1870. The tree is distinguished by its considerable height (growing to about 25 ft. high if left to itself), its large, thick leaves, and comparatively large berries. It does not require permanent shade, bears fruit almost throughout the year, and the berries do not drop when ripe, as do those of the Arabian Coffee. Neither do the berries become soft when ripe, like those of the latter, but remain hard and fibrous; the permanent skin is also comparatively tough, so that the labour entailed in cleaning is increased. The aroma of the bean is not generally highly appreciated, which results in a lower market price for the product. The vigorous constitution of the Liberian coffee-tree renders it more or less resistant to the effects of the leaf-disease. Suited to low elevations only, i.e., up to 2,000 ft. The trees may be planted about 8 ft. by 8 ft. apart, and should be topped at a height of about 6 or 7 ft.

Congo Coffee. (*Coffea robusta*).—A species of coffee indegenous to the Congo, recently brought into cultivation, and not unlike the Liberian coffee, having large handsome wavy leaves. It is said to give very satisfactory returns in the Straits as well as in Sumatra and Java for at least a few years, being especially in favour as an intercrop with young rubber. It thrives best from 1,000 to 3,000 ft. elevation, yields a crop of about 1 cwt. per acre in 2 years from planting, 4 to 5 cwt. in the 3rd year, and 14 to 18 cwt. in the 4th year. I am informed that even a yield of 24 cwt. per acre has been obtained in the 6th year. The bean fetches at present from 54*s*. to 64*s*. per cwt. This species has been introduced at Peradeniya Gardens in 1900, and thrives well here.

Sierra Leone Upland Coffee. (*Coffea stenophylla*).—A slender-stemmed West African species, bearing a profusion of small oval berries, which are black when ripe. This is said to be superior in flavour to all other coffees. The plant has been introduced in 1894 at Peradeniya, where it flourishes and bears fruit in abundance twice a year.

Hybrico Coffee.—A Brazilian variety whose fruits contain four or six instead of two seeds; its quality is well spoken of, but it does not appear to be known in the East.

Maragogipe Coffee.—Another kind from Brazil, with large leaves, similar to those of the Liberian Coffee. This has been

established at Peradeniya since 1884, but although the tree flourishes here it is not a prolific bearer. The flowers and fruit are similar to those of the Arabian Coffee.

Hybrid Coffee.—The most important of hybrid coffees growing at Peradeniya is a cross between the Arabian and Liberian species. This obviously partakes of the character of both the parents, and bears a heavy crop of good-sized berries. The plant is a vigorous grower, and its robust constitution appears to render it to some extent resistant to the coffee-leaf disease.

Mocha Coffee.—Arabian-grown coffee is generally known by this name, and is so-called because it was formerly shipped entirely from Mocha. It is a variety of *Coffea arabica*, with rather small berries, and its cultivation is confined to the province of Yemen in South-western Arabia.

Cotton; "Pulun," *S.*—This consists of the delicate hair-like fibres which clothe the seeds of various species of *Gossypium* (of the Natural Order Malvaceæ), which though shrubby perennials in nature are usually cultivated as annuals. Cotton is the most important of all textile fibres, and has been used in India from time immemorial. The principal cotton-producing country is the United States, those countries coming next in importance being Egypt, India and Queensland. The cotton plant requires a rich friable deep soil (black humous soil being considered the best), a warm climate with a wet season of 2 or 3 months followed by dry weather. It is suited to the semi-dry region of Ceylon, especially in the North and North-Central provinces, where it appears to have been cultivated from remote times. In some of the principal cotton growing districts of South India, the annual rainfall is only about 27 inches. With, however, a limited rainfall, such as this, irrigation must be resorted to. Shade trees must be avoided, but strong winds are injurious to the crop. The seeds, which must be fresh, should be sown in the rainy weather, at such a time as will result in the crop being picked in the dry season. After the land is ploughed and harrowed, sow the seeds in rows, allowing 4 to 5 ft. between the latter and about 2 ft. between the plants in the row, say 5,000 plants to the acre. It is usual to sow 2 to 4 seeds to the hole, 4 inches apart; the weaker seedlings are afterwards pulled out, leaving the strongest one. About 6 lb. of seed* is thus sufficient to sow one acre. In fairly moist districts the ground should be thrown up in drills, but in dry regions with loose soil, level cultivation

* 1 lb.=about 4,000 seeds.

should be adopted. Vacancies should be supplied by seeds, not by plants when thinning out, as transplanted plants are seldom successful. The crop is ready for picking in 5 to 6 months (according to variety) from the time of sowing. In Ceylon, it is best to sow in October or November (rainy season), the crop thus maturing in March and April, which are dry months. When ripe, the pods burst, and the cotton bolls are then picked by hand. The cotton is afterwards thoroughly dried in the sun (thus getting rid of stainers and other insects), being then separated from the seed by a ginning machine, after which it is made up into compressed bales for export.

Grading, which is of great importance, should be begun in the field and completed in the factory or store, it being essential to sort the cotton according to quality into 2 or 3 grades so as to obtain more or less uniform qualities. An average of 30 to 40 pods per plant is considered a fair average crop, though some plants may bear as many as 100 pods. Fifty pods should yield 1 oz. clean cotton, and an acre may produce from 200 to 400 lb. ginned cotton (or 1,000 lb. seed cotton), or more according to soil and cultivation. The seeds also yield a revenue, these being largely used for cattle food as well as for the extraction of oil. Cotton by itself has not as yet been found a very remunerative product in Ceylon, but as a catch-crop with coconuts, rubber, etc., it may furnish a subsidiary source of revenue. The export† from Ceylon in 1912 was 140,171 lb., valued at Rs. 64,605.

VARIETIES.—The numerous varieties may be classified under the two main types of *long staple* and *short staple*. To the former belong the *Sea Island* cotton (Gossypium barbadense) considered the best of all cottons, owing to the length (about 2 inches) and silkiness of the fibre ; also the *Egyptian Cotton*, a variety of the Sea Island kind. Of these again there are numerous varieties ; one of the best of the Egyptian class is the Mit-afiffi. Of the short-staple varieties, the *American Upland* (Gossypium hirsutum) is generally considered the best and is in greatest general demand in commerce ; it has given the best results at the Maha-illupalama Experiment Station, Ceylon. *Peruvian Cotton* (G. barbadense var.), *Indian Cotton* (G. herbaceum and G. neglectum) are also short-staple varieties. *Tree Cotton* (G. arboreum), is a small tree, attaining a height of 14 to 20 ft., considered a native of Africa. *Caravonica :* a perennial, bushy hybrid-cotton, raised recently in Queensland ; said to yield about 3 lb. per tree a year. *Allen's* and *Sunflower* varieties have proved superior to *Egyptian* cotton in Uganda, giving a yield of well over 300 lb. per acre (*Vide* Uganda Administration Report, 1911-12).

Silk Cotton or Kapok. (*Eriodendron anfractuosum.** Malvaceæ) A moderate-sized, quick-growing, upright thornless tree, indigenous to tropical Asia and Africa. A striking peculiarity of the tree

†Ceylon Customs Report. *=*Ceiba pentandra.*

is the manner in which the branches stretch out horizontally in whorls, at right angles to the stem. The tree is deciduous in the dry season, January to April, the greenish-white flowers being produced in clusters shortly after the leaves have dropped, and the fruit pods which follow are ripe about three months later. The latter contain a quantity of silky cotton (kapok), and when ripe burst open and disperse their contents. The pods should therefore be collected before they are quite ripe, being then dried in the sun. Kapok is largely used for stuffing pillows, mattresses, upholstering, etc., both in the countries where grown and in those to which it is exported. The largest supply come from Java, where the trees are planted as a secondary product. The export of kapok from that country has increased from 1,125 tons in 1899 to over 8,000 tons in 1911. In the latter year about 100 tons were exported from the Philippines, while in 1912, 255 tons* were exported from Ceylon, valued at £ 9,140. There is a steady demand for the product which has considerably advanced in price during the last few years, and now stands at about 6*d*. to 9*d*. per lb. according to grade. The tree is readily propagated from seed or cuttings, and thrives from sea-level up to about 2,000 feet. It attains a height of about 30 to 50 feet or more, and may be planted about 18 feet apart each way. Planted along roadsides or as wind-belts, the trees may be used as supports for Pepper vines.

Yield. The trees begin to yield about the fifth year from planting, and may be expected to yield 3 to 4 lb. of lint when 6 to 7 years old, increasing later to 7 to 8 lb. A good tree at maturity should produce 1,000 to 1,500 fruits a year. On an average 100 fruits should contain about a pound of clean fibre. The weight of the seed in a pod is about double that of the fibre.

Red Cotton-Tree, "Katu-imbul" (*Bombax malabaricum.* Malvaceæ). A very large handsome tree, 80 to over 100 ft. high, common in the low-country of Ceylon, South India, etc. It is quite deciduous for 3 or 4 months in the year (usually January to April), the large scarlet fleshy flowers quickly following the shedding of leaves, and the fruit is ripe in April. The woody pods, like those of the Kapok, contain a quantity of white silky lint which, though less valuable, is sometimes used for mixing with Kapok cotton. (See *Beautiful Flowering and Foliage Trees*).

Croton-Oil; "Jayapala," *S.*—This powerful purgative, used in medicine, is extracted from the seed of *Croton Tiglium* (Euphorbiaceæ), a small tree or large shrub, native of India. The cultivation

*Ceylon Customs Report.

of the plant has been undertaken in Ceylon a few years ago, when the seeds were sold in London for 70*s.* to 80*s.* per cwt., but a large shipment speedily reduced the price, and the cultivation soon declined. The product is, however, still cultivated here to some extent, the export of the seed in 1912 being given as 785 cwt., valued at £ 2,197. The present price of the seed in Colombo varies from Rs. 22 per cwt. upwards, according to quality and demand.

Kitul Palm; Toddy Palm. (*Caryota urens*).—A very handsome palm, indigenous to Ceylon, with large spreading bipinnate leaves. From the young flower raceme is obtained, by means of tapping, a copious flow of sweet sap, which upon boiling yields a quantity of sugar or jaggery. In a fermented state it is distilled to produce arrack. Each flower raceme is said to continue to yield for 1½ to 4 months, producing on average from a half to 2 gallons toddy a day, or a single tree an annual yield of about 180 gallons.

Kola-nut; "Bissy" or "Gooroo nuts." (*Cola acuminata.* Sterculiaceæ). A small tree, 30 to 40 feet high, indigenous to West Tropical Africa, cultivated for its large white or pink seeds, which become reddish brown when dried. It bears warty oblong pods, 4 to 6 inches long, which contain from four to ten or more seeds. The latter are highly prized as a masticatory in tropical Africa on account of their stimulating and sustaining properties, due to the presence of the alkaloid *caffeine* (also found in coffee), and to a small extent of *theobromine* (active principle of cacao). The dried nuts (seeds) are imported into Europe, etc., and used in medicine as well as for the manufacture of kola wine and other beverages. As a vegetable product, the Kola-nut ranks next in importance to the Oil-palm (Elæis) in West Tropical Africa. The tree was introduced into Ceylon in 1879, and has become established in the moist low-country up to about 1,600 feet, being cultivated to a small extent as a minor product in conjunction with tea; the seeds are simply dried and exported. Kola-nuts occur under two different species, viz., *Cola acuminata* and *C. vera.* The seeds of the former possess four cotyledons, and those of the latter (supposed to be the more valuable) only two.

The tree is propagated from seed, which must be sown perfectly fresh ; it bears fruit when six or seven years old, producing two crops a year, equivalent of 500 to 800 pods, or about 50 to 120 lb. of seeds per tree. In cultivation, the trees should be planted about 18 feet apart each way. The product is prepared for the market by merely drying in the sun. In 1890, kola-nuts were

worth 2*s.* 9*d.* per lb. in London, while at the present time (1913) the London price is reported as varying from 2½*d.* to 4½*d.* per lb. according to quality. They are exported from the West Coast of Africa to some considerable extent. The export of Kola-nuts from Ceylon in 1912 was 97 cwt., valued at £77. The Kola-nut tree has been introduced into various tropical countries, and is said to have become naturalised in the West Indies.

NUX-VOMICA. *Strychnos Nux-vomica.*

Nux-vomica. Goda-kaduru, *S.*; Kanchurai, *T.* (*Strychnos Nux-vomica.* Loganiaceæ). A moderate-sized tree with opposite shiny leaves, indigenous to Ceylon (forests of the dry region), India and Burma. The flat, circular, ash-grey poisonous seeds, produced chiefly from August to November, are collected from wild trees, and exported for the purpose of extracting from them the alkaloid

strychnine, valued in medicine as a tonic and stimulant. The amount of these seeds exported from Ceylon in 1909 (all to England, Germany, and America) was 782 cwt., valued at £239, while in 1912 the export fell to 21 cwt. The globular fruit is of the size of an orange, yellow when ripe, and contains a mass of soft pulp, upon which monkeys and certain birds feed.

Orchella-weed. (*Roccella Montaguei*).—A pale geenish-grey lichen, with flaccid ribbon-like fronds, found growing in the hot, dry districts of Ceylon, close to the coast, specially on sea-shore rocks. The plant is collected, dried and exported for the purpose of manufacturing litmus, orchil, etc. The value of Orchella-weed exported from Ceylon in 1909, to Belgium only, was given as Rs. 50. "Fair Ceylon Orchella" is quoted at about 15*s*. per cwt. in London. The demand for this is limited, and the collection of the plant is now scarcely a profitable industry.

Palmyra Palm; "Tal-gas," *S.*; "Panna-maram," *T.* (*Borassus flabellifer*.—An erect diœcious palm, 60 to 70 ft. high, with a stout trunk and fan-shaped leaves, indigenous to the dry region of Ceylon, India, and Africa. It is naturally suited to a rather dry climate, and is extensively cultivated in India, Burma, Malaya and in the dry northern parts of Ceylon, more especially for the sake of the fruit and leaves; these and other parts of the palm are put to numerous uses, like the Coconut-palm in the humid districts. The large black fruits ("nuts") are borne in a cluster at the base of the leaves; they contain a refreshing sap, much relished as a cooling drink; the soft kernels of young fruits are much used as an article of food, being sold in Ceylon in large quantities at the bazaars during the months of April and May. The copious sap obtained from the flower spathes is collected and either used for drinking as toddy (unfermented), or fermented and distilled for producing arrack (an intoxicating spirit); otherwise it is boiled down for making sugar or jaggery. The period of tapping for toddy extends from 1 to 3 months in the dry hot season, and the yield of the liquid varies from 30 to over 100 gallons per tree, or from 3 to 4 bottles a tree per day. The young leaf blades are used for making fans, baskets, buckets, ola, etc.; while the leaf-stalks and mid-ribs furnish an excellent brush-fibre, which forms an article of export. To obtain the latter, the trees are stripped of all but three leaves once in two years. The trunk yields a hard and most durable timber, and the husks are in demand for fuel. The annual export of palmyra fibre from Ceylon

is valued at about £15,000 (the price varying according to quality from 25*s*. to 50*s*. per cwt.), and of palmyra laths, £3,840.

In the East the Palmyra palm ranks next in importance to the Coconut among palms, and the acreage under cultivation in Ceylon alone is estimated approximately at 40,000 acres, while that in Tinnevelley is said to be about 60,000 acres. It is propagated from seed, which is sown *in situ* in holes made in sandy soil. In about 8 to 10 years from sowing, the palms should be in flower, when they may be used for drawing toddy and making sugar; the total outlay in ten years for bringing the trees into bearing is usually estimated at Rs. 14 per acre. When grown for the fruit, an average return of about 3,500 nuts per acre may be obtained. At the end of eighty years the value of the stems (for timber, etc.) is considered to be about £40 or more per acre.

Sappan-wood. Pattangi, *S.* (*Caesalpinia Sappan.* Leguminosæ).—A large straggling spiny shrub or small tree, indigenous to India and Malaya, introduced and naturalised in the moist low-country of Ceylon. The reddish heart-wood yields a red dye, and is exported to some extent from Ceylon; the amount exported has dropped from 11,099 cwt. in 1908 to 4,758 cwt. in 1912, the latter being valued at about £1,152. Sappan-wood realises locally from Rs. 35 to Rs. 40 (say £ 2·13·6) per ton.

Sugar-Cane. Uk-gas, *S*; Karambu, *T.* (*Saccharum officinarum.* Gramineæ).—A tall grass or reed, reaching a height, in cultivation, of 8 to 12 ft. or more, found in a cultivated state in all tropical countries, in some extensively grown for the sake of the sugar obtained from the thick succulent stems. The Sugar-cane has been grown for sugar from time immemorial. The chief countries of cane-sugar production now are Mauritius, the Guianas, Java, Hawaii, India and the West Indies. The plant requires a hot humid climate, alternating with dry periods, and thrives best at low elevations on flat or sloping land, with porous sandy-loam or alluvial soil, the presence of a certain proportion of lime being essential; it flourishes, however, on any ordinarily good soil, provided the necessary moisture is available. The crop is an exhausting one, and manuring is indispensable. Propagation is by cuttings, which, being selected from the upper joints of the canes, are cut in lengths of 8 to 10 in. (including 3 or 5 joints) and placed in lines or trenches, 10 to 12 in. deep and V-shaped in section. The cuttings are inserted two or three together, a few inches apart, in a slanting direction, and covered with

soil with the exception of an inch or two at the top. The distances between the lines or trenches, and between the plants in the latter, vary according to variety of cane and conditions of soil, but under average conditions they may be said to be 5 ft. by 4 ft. The cuttings (called "plants") sprout in 10 to 14 days; the first or "mother" sprout is cut off so as to induce the plant to tiller. Subsequently weeding and forking up of the soil occasionally must be attended to. All dead leaves (called "trash") should be left on the canes in dry weather, but in wet weather or in rich soil they should be removed and left on the ground to rot and form a mulch.

Harvesting commences in 12 to 14 months from the time of planting, the canes becoming tough and turning a pale yellow colour when ready for cutting. They are cut as close to the ground as possible, for nearer the root the better the sugar content. The roots or stools will continue to crop for at least 3 or 4 years, sometimes as many as 8 or more, the subsequent crops being known as *ratoons*, these being "first," "second," or "third" ratoon, etc., according to the number of crops obtained.

Yield, etc. Under favourable conditions a good variety will yield 30 to 40 tons of canes or more per acre; but under ordinary circumstances the yield may not be more than 20 to 25 tons, varying according to variety of cane and soil. FAWCETT considers the average yield in Jamaica to be about 22 tons per acre, and LYNE estimates the average yield in Portuguese East Africa to be about 25 tons. The best varieties of cane, under suitable conditions, should give about one ton of marketable sugar for every 10 or 11 tons of cane; thus the crop may vary from 2 or 3, to 4 tons of sugar per acre. The canes are put through machinery, which either crush, macerate, or slice the canes longitudinally. The sweet saccharine juice is afterwards submitted to processes of clarifying (in which unslaked lime is used to neutralise the acids), then heating, filtering, bleaching, etc. The fibrous material left after the juice is extracted is known as "megass," which is used as fuel for the machinery. Raw-sugar or "muscovado" is boiled and clarified to form crystallized or white sugar, and this is at once ready for the consumer. To make loaf or lump sugar, the muscovado is exported. Molasses and treacle, from which rum is made, are the uncrystallizable product drained from the muscovado or raw-sugar.

VARIETIES.—Numerous varieties are in cultivation, and in recent years many seedling varieties, which considerably

exceed the older sorts in yield of sugar, have been raised and cultivated, making sugar-planting a more profitable industry, and enabling it to compete with the beet-sugar. "Otaheite" and "Bourbon" are old favourites in the West Indies. "Yuba" is the principal variety grown in Natal and Potuguese East Africa, where, according to MR. LYNE, it sometimes gives as many as 12 ratoons. Sugar cultivation has been tried on various occasions in Ceylon, but though the growth of the cane has been all that could be desired, the industry has not proved a commercial success, owing, it is said, to "too much water and too little saccharine matter in the juice" of the canes. Some small areas are, however, still cultivated in the Galle district from which sugar is made locally. A considerable quantity of sugar-cane is grown in native gardens for chewing purposes; the total area under the crop in Ceylon is estimated at about 1,000 acres. The plant thrives up to 2,500 feet in the moist region.

Sugar Sorghum.
Sugar Palm } See *Miscellaneous Products.*

Vanilla. See *Tropical Spices.*

CHAPTER XXIV.

MISCELLANEOUS ECONOMIC PRODUCTS

1. EDIBLE PRODUCTS
2. DRUGS
3. OILS
4. FIBRES
5. TANS
6. VEGETABLE WAX, GUMS AND RESINS

EDIBLE PRODUCTS:

Arabian Tea. "Khat," "Cat," or "Cafta." (*Catha edulis.* Celastraceæ).—A small shrub of Arabia and East Tropical Africa, introduced to Peradeniya in 1882, where it flourishes in ordinary soil, without shade. The leaves and young twigs form a considerable article of commerce among the Arabs, being chewed both in the green and dry state, as a stimulant and to promote wakefulness. A decoction resembling tea is made from the leaves, although these are considered by Europeans to contain no trace of caffeine.

Ayapana Tea. (*Eupatorium Ayapana.* Compositæ).—A low, spreading herbaceous plant, 2 to 3 ft. high, with long narrow leaves, which and the stems are of a bronze tint. It is indigenous to Brazil, and is said to be cultivated to some extent in Mauritius and Reunion for the sake of its medicinal properties. The leaves and young twigs are used for making a decoction like tea, and this is said to be a mild stimulant and a cure for dyspepsia. The plant is also cultivated in parts of India, where it is similarly employed and esteemed. It is easily propagated by cuttings or division or division of the roots, and thrives on ordinary soil, in partial shade, up to 2,000 feet. The plant has a characteristic habit of rooting freely at the nodes; but it seldom produces seed.

Maté, Yerba de Maté, or Paraguay Tea. (*Ilex paraguayensis.* Ilicineæ),—A small bushy tree, with serrate alternate leaves, not unlike those of the Tea plant proper. It is a native of South America, where it is largely cultivated, the leaves being used as tea. In Brazil and Paraguay the dried leaf forms one of the leading articles of local commerce, being also exported in considerable quantities

to neighbouring countries. According to Dr. Willis, Director of Botanic Gardens, Rio de Janeiro, the export of Maté from Brazil alone in 1911 was about 139 million pounds, valued at nearly 2 million pounds sterling, averaging over 3*d*. per lb. In preparing the leaves for use, they are first partly dried in the sun near the place where they are gathered, then toasted, which latter process requires practically all the skill necessary in the preparation of the product. The leaves must be dried thoroughly and evenly, without

AYAPANA TEA. *Eupatorium Ayapana.*

scorching; they are then usually ground small and packed solidly into bags for market. An infusion from the leaves, which is customarily drunk from the spout of a tea-pot, or sometimes through a tube with a net-work at the bottom, called the bombilla, is the favourite drink of a large proportion of the population of Brazil, Paraguay, Uruguay, and the Argentine Republic, etc. The leaves contain a small percentage of caffeine, and are occasionally imported into Europe. The plant was introduced in 1897 to Peradeniya, where it has been found to thrive under ordinary

conditions. It appears to be suited to different elevations, in moist districts, up to at least 2,000 feet.

Sago Palm.—The sago of commerce is obtained chiefly from the stems of *Metroxylon Sagu*, a pinnate-leaved palm, 30 to 40 ft. high, with a short cylindrical and usually recumbent or creeping trunk. The palm is indigenous to the Malaya Archipelago, where it is commonly cultivated or conserved for the sake of the sago. It is found chiefly in damp, flat or swampy situations, and thrives

1. ASSAM OR ORDINARY TEA. 2. PARAGUAY TEA.

best in cultivation when these conditions are imitated. The life of the individual palm extends to fifteen or twenty years, the tree flowering at that age and then dying; younger palms arising from suckers and in various stages of development are, however, produced around it. In a properly managed sago swamp, the palms should be allowed to stand at suitable distances apart, and all unnecessary suckers and stems removed. In this way the ground should be continuously productive without much, if any, replanting. The seeds, which are seldom fertile, are said to occupy two or

three years in ripening, but, as has been stated, propagation is easy and best from suckers. To obtain the sago, the tree is felled when it commences to flower (which is usually at about the age of 10 years), the farinaceous matter in the stem being then in its best state of development; the trunk is cut into pieces of 3 or 4 ft. long and these are split in two. The farinaceous substance is then

Metroxylon Sagu. SAGO PALM OF MALAYA.

extracted and reduced to a powder, which is mixed with water and strained through a sieve. The water being allowed to stand, the starch settles in the bottom, when the water is poured off, and the starch thoroughly washed and afterwards dried. This forms *sago meal*, which is made into *granulated sago* by mixing with water to form a paste, being then rubbed through sieves to cause granulation, after which it is dried in ovens or in the sun. The process

of obtaining and preparing the sago varies, however, to some extent in different localities. A single tree is said to yield from 800 lb. to 1,400 lb. of the finished article. England alone imports sago (chiefly from Singapore and Sumatra) to the extent of about 4,000 tons annually. The Sago palm was introduced at Peradeniya in 1880 and has flourished here since, being grown in a moist situation with loose deep soil. Here the trees flower freely and set

Cycas circinalis. SAGO PLANT OF CEYLON

fruit, but have not as yet produced fertile seeds. Several varieties are recognised, these being either thorny or smooth-stemmed; the latter quality indicates the best and most prolific trees.

Sago Plant of Ceylon; Madu, *S.* (*Cycas circinalis.* Cycadeæ). A palm-like plant, 12-15 ft. high, with very handsome, long, feathery leaves; the large farinaceous seeds are commonly made into a useful sago by the Natives.

Sugar Palm of Java. Gomuti-palm. (*Arenga saccharifera.*)—A large erect palm, with a stout trunk and very large stiffish pinnate leaves, indigenous to Malaya. It is cultivated in Java for the production of sugar, which is obtained by evaporation of the sap, the latter being obtained from incisions made in the young inflorescence, similar to the manner in which the Coconut and Kitul palms are tapped for toddy in Ceylon. The palm flourishes in the moist low-country up to about 1,600 ft. In Java it is said to thrive best at an altitude of about 1,000 ft. A sugar yield cannot be obtained until the tree has reached its flowering stage, viz., about its twelfth year, and the productive period extends to four or five years, i.e., so long as the palm continues to flower, after which it dies. A single tree is considered to yield in this time "as much as 450 lb. of sugar. Thus an acre bearing 100 trees, would yield about 20 tons, which works out at rather more than one ton of sugar per acre per annum." Catch-crops may be grown beneath the palms for at least the first few years. Like many other palms, the heart of the stem contains a large quantity of excellent sago, hence it is sometimes known as the "sago-palm."

Sugar Palm of India, or Wild Date. (*Phœnix sylvestris*).—A tall palm with stiff feathery leaves, allied to the Date palm, native of India, where it is sometimes extensively cultivated for the production of sugar or jaggery. It is estimated that in the Madras Presidency alone there are 22,000 acres under the cultivation of this palm. The method of obtaining the sugar is similar to that adopted with the Coconut and other palms, viz., tapping the flower-stalk for the juice, which exudes copiously and is afterwards boiled and evaporated; on cooling, a solid mass of brown toffee-like sugar remains. Jaggery or palm-sugar is extracted in large quantities in Ceylon from the Kitul-palm (*Caryota urens*), the Coconut palm and the Palmyra palm, the mode of procedure being the same as that described above. In 1890, jaggery was exported from Ceylon to the extent of 6,428 cwt., valued at £2,259, but the figures have declined to 1,207 cwt. and £380 respectively in 1908.

Sugar-sorghum; Imphee. (*Sorghum saccharatum*).—A tall-growing grass similar to Guinea corn, sometimes cultivated for the sugar obtained from its stems, which is chiefly used in the preparation of sugar-candy. Being somewhat hardier than the sugar-cane, it may be profitably grown in climates where the latter would not succeed. The plant has long been cultivated in India and more recently in the Southern United States, for the production

of sugar and syrup. Numerous varieties are recognised. Like the Guinea-corn, Sugar-sorghum may be grown in ordinarily good soils, but gives the best yield on a moist sandy loam. In dry weather it is much benefited by irrigation.

DRUGS

(See also plants used in Native Medicine in Ceylon).

[*S*=Sinhalese; *T*=Tamil].

Cassia Fistula. "Ehela," *S.* (Leguminosæ).—A large tree, indigenous to the dry region of Ceylon, also to India and

CUBEBS. *Piper Cubeba.*

Malaya. The long cylindrical pods (½ ft. to 3 ft. long) are valued in medicine, and are exported from India and the West Indies, being sold in London at about 18*s.* to 22*s.* per cwt. The bark of the tree is esteemed in native medicine in Ceylon.

Cinchona. See *Minor Products of Ceylon.*

Cubebs. (*Piper Cubeba.* Piperaceæ).—The Cubebs of commerce, which are of importance chiefly in medicine, are the berries of a species of a pepper-vine, easily distinguished from the ordinary pepper by the stalked and larger berries or "corns." The plant is a native of Java, Sumatra, etc., and thrives under similar

conditions as Pepper, requiring live or artificial supports and a certain amount of shade. The world's supply of cubebs is obtained chiefly from Java, where the plant is cultivated. Cubebs thrive at Peradeniya, where they are grown on Erythrina trees, and bear fruit freely. The plants are best propagated by cuttings taken from the top or fruitful shoots, the plants thus raised being more productive than those taken from near the base.

Ginseng.—The Chinese name for the root of *Panax* (*Aralia*) *quinquefolia* (Araliaceæ), a small plant with palmate leaves, native of North China. Ginseng cultivation is a Government monopoly in Corea, and the dried root forms one of the principal articles of export from that country to China. During 1905, China received from Corea alone 107,480 lb. of "Red Ginseng" of the value of £112,350. This variety ranks in quality next to Manchurian or "Imperial" ginseng. The roots are prepared for export by steaming for about four hours in wicker baskets placed over boiling water. So highly valued is ginseng in China, as a tonic and stimulant medicine, that "it is sold at from 20 to 250 times its weight in silver, sometimes for 500 times this amount." From a supposed resemblance of the root to the human form, Chinese doctors ascribe miraculous powers to it, claiming that it wards off disease and restores exhausted animal powers, even making old people young. The root is slightly bitter and aromatic, but is not regarded by European medical men as having any medicinal value. A variety of Ginseng is also furnished by a similar species found in North America. This is cultivated to some extent in the United States, where the roots are sold at from two to four dollars per pound for exportation to China as a substitute for the Eastern product. This variety is ranked by the Chinese as fourth in quality, next to this being Japanese ginseng, which is the least esteemed. The plant thrives best in a rich loamy loose soil, and requires light shade as well as a moderate amount of moisture.

Ipecacuanha. (*Psychotria* (*Cephaelis*) *Ipecacuanha.* Rubiaceæ). —A small bushy perennial plant with semi-creeping stems, indigenous to the dense humid forests of Brazil. From its peculiar annulated roots an extract is obtained which is used in medicine as a well-known emetic, and also as a specific for dysentery. The supply of the root comes chiefly from Brazil, and this is frequently adulterated with roots of a similar appearance. Ipecacuanha is imported into England to the extent of about 50,000 lb. a year, and commands a price of 4*s.* to 6*s.* 6*d.* per lb.

The plant responds to cultivation under conditions similar to those of its native habitat. A loose loamy or humous soil suits it best. As the roots penetrate the ground deeply, the soil should be trenched to a depth of about $2\frac{1}{2}$ ft. LAWSON, late Government Botanist, Madras, found that "a healthy plant will yield ten to twelve good roots of the necessary quality, these when dried weighing from 3 to 4 ounces." PROUDLOCK estimated from experiments

IPECACUANHA. *Psycotria Ipecacuanha.*

made at Ootacamund, in a hot-house, that $2\frac{1}{2}$ oz. of the dried root could be obtained per square yard per annum, or 625 lb. per acre, the plants being planted in raised beds. The Ipecacuanha plant has been introduced into Ceylon in 1866, and thrives both in Peradeniya and Heneratgoda Gardens, more especially at the latter, under the shade of trees, in well drained humous soil. It is best propagated by cuttings or division. The plant is grown

successfully in the Straits Settlements, whence the dried roots are exported to some extent. Recently the active principle of Ipecacuanha has been prepared in the form known as emetine, which is much used for dysentery and bowel complaints; consequently the demand for the product has of late considerably increased.

Menthol, Peppermint or "Peppermint Camphor." (*Mentha piperita*. Labiatæ).—A dwarf creeping herb with a strong aromatic odour. A volatile oil obtained from the plant is well-known in medicine as an antiseptic, stimulant, and carminative; this yields the crystalline camphor-like substance known as "menthol," commonly used for neuralgia, etc. Menthol and menthol-oil are exported from Japan, the former being worth from 16*s*. 6*d*. to 17*s*. 6*d*. per pound. The plant thrives at Hakgala Gardens, forming a dense carpet on the surface of a raised bed of rich soil.

Opium.—This well-known and valuable narcotic drug is obtained from the milky juice of the unripe fruit capsules of the Opium Poppy (*Papaver somniferum*, Papavaraceæ), an annual plant native of India and Asia Minor, where, as well as in China, it is extensively cultivated. The method of collecting the drug is to make light incisions or scratches in the green unripe fruit; this should be done in dry weather, in the evening; by the morning the milky juice which flows out will have coagulated, and is then collected and made into balls, which form the common opium of commerce. From this morphia, the active principle, is obtained. The yield of opium in India is said to average about 18 lb. per acre, valued locally at 4*s*. to 5*s*. per lb. In Queensland, it is said an average of about 20 lb. to 25 lb. per acre can be obtained, commanding about 25*s*. to 30*s*. per lb. The market price however appears to fluctuate considerably. The small seed is sown in drills 2 feet apart, with 9 in. between the plants in the drills. The plants blossom in 2½ to 3 months from planting; the petals are removed, and the capsules are ready about 10 days later for the collection of opium.

There are two distinct varieties of the opium poppy, viz., var. *glabra* which furnishes medicinal opium and is chiefly grown in Asia Minor; and var. *alba*, which is the one principally grown in India and China, yielding the opium used for eating, drinking, or smoking. Considerable restrictions have been placed in recent years on the consumption of opium in Eastern countries. A very large number of persons in the East take the drug all their life without showing a tendency to increase the daily allowance.

Quassia, Quassia-chips or Bitter-wood (*Picraena excelsa.* Simarubaceæ).—A West Indian tree, the wood of which is largely used in Europe and elsewhere as a source of an intensely bitter liquid, which is extracted and used against aphides and other insects. A ton of quassia chips yields only 10 oz. of the bitter principle, but this is capable of embittering 24,000 gallons of water. To obtain the bitter contents, 1 lb. quassia chips should be steeped in cold water for a few hours and then be simmered for 12 hours in 1 gallon water. See under *Insecticides.*

Sarsaparilla.—A drug obtained from the roots of various species of *Smilax* (Liliaceæ), and used for rheumatism, gout, etc. The genus *Smilax* are climbing plants, characterized by more or less thorny stems and large leaves, found in a wild state in the West Indies, Central America, Mexico, etc. *Smilax officinalis* furnishes the Jamaica sarsaparilla, while other different species supply the Brazilian and Mexican product. *S. officinalis* thrives at Peradeniya, where it has been introduced in 1880. Several species of *Smilax* are indigenous to the moist regions of Ceylon, being found up to about 4,000 ft. The collection of sarsaparilla is effected by scraping away the earth covering the roots, which run horizontally under the ground; when laid bare, they are cut off near the crown, a few slender roots being allowed to remain to assist the plant in renewing its growth. The collected roots are then dried and packed in bundles for exportation. The present price of Sarsaparilla in London is about 1*s.* to 1*s.* 3*d.* per lb.

Indian Sarsaparilla; "Iramusu," S. (*Hemidesmus indicus.* Asclepiadeæ).—A small slender twining plant, found wild in the moist low-country of Ceylon, also in India. The roots are much used as a tonic medicine, being included in the British and Indian official pharmacopœias.

Senna Leaves, or Senna Pods.—The dried leaves or pods of certain species of Cassia, which are imported into Europe, etc., for use in medicine, being well-known for their mild laxative properties. Tinnivelly senna, the best known in commerce, is furnished by *Cassia angustifolia*, a small shrub, native of Arabia and East Africa, and largely cultivated in parts of South India. Alexandrian or Nubian senna is obtained from *Cassia obovata*, a shrubby plant of Egypt, now naturalised in Jamaica. Senna leaves fetch at present from 4*d.* to 6*d.* per lb. in London.

Thymol is prepared (by distillation) from the oil of Ajava or Ajowan seeds, produced by *Carum copticum*, a small Umbelliferous

plant largely cultivated in parts of India. The oil is used medicinally. The plant is not grown in Ceylon.

OTHER MEDICINAL PLANTS

Name.	Natural Order, etc	Principal Use.
Asclepias curassavica. Wild Ipecacuanha	*Asclepiadeae*; a perennia	Root a good substitute for Ipecac. proper.
Brayera sp. "Koso"		Dried fl's used as a purgative, also for tapeworm, in East Africa, etc.
Combretum Sundaicum.	*Combretaceae;* a large climber	Antidote for opium habit.
Ipomoea Purga. Jalap	*Convolvulaceae;* climber or spreading shrub.	Strong purgative.
Pilocarpus jaborandi.	*Rutaceae.*	Yields an alkaloid "pilocarpine," of value in medicine.
Rhamnus purshiana. **R.—Californica.** } Cascara sagrada	*Rhamnaceae*	Extract from dried bark: well-known aperient.

OILS

Castor-oil; Endaru-tel, *S.*—This well-known oil is obtained from the seed of *Ricinus communis* (Euphorbiaceæ), a tall, quick-growing annual with large palmate leaves. Besides its use in medicine, castor-oil is largely employed for lubricating purposes, also in soap manufacture, etc. Important bye-products are obtained after the expression of the oil from the seed, viz., *castor poonac*, used as cattle-food, and *castor cake*, a valuable manure. The castor-oil plant has become naturalised in Ceylon, and often occurs as a weed in cultivated ground in the moist low-country, up to about 3,000 ft. It is cultivated commercially in India, Southern Europe, United States, etc. The plant thrives in ordinary soil, but does best in open friable, humous or alluvial soil. About 10 lb. of seed is sufficient to sow an acre; the seed should be set in rows 5 by 6 ft. apart, two to three seeds being sown in the same place a few inches apart, and the seedlings afterwards thinned out to one in each hole. The plants begin to bear in about four months from the time of sowing, and the harvest should be completed two months later. Under favourable conditions the yield should be from 20 to 30 bushels of seed per acre; in the Southern United States the yield is said to be about the same as that of wheat, varying, like the latter, with the fertility of the soil. Good seed for oil production is usually worth about 5*s.* per bushel or £12 per ton in

Europe. Enormous quantities of castor seed and poonac are imported annually into India, Ceylon, Malaya, etc.

Gingelly-oil; "Til" or "Benni;" "Tala-tel," S. (*Sesamum indicum.* Pedaliaceæ).—An annual plant, 2 to 3 ft. high, indigenous to Ceylon, South India, and tropical Africa, extensively grown in India on account of the small seeds, which are rich in oil. Gingelly-oil, obtained from the seed by expression, resembles almond-oil, and is used for blending with the latter. It is a good table oil, being used throughout India and Ceylon in cooking and medicine; in England it is used chiefly in soap-making, but also for mixing with olive-oil. In France it is said to be commonly used for salads. The plant may be grown as a summer crop in a subtropical climate, as Italy and the Southern United States. The seed is sown broadcast after the land is ploughed, and the crop is ripe in about four months' time. The plants being cut, they are tied in bundles to dry, and the pods upon drying burst and disperse the seeds. About 20 bushels of seed may be obtained from an acre, which will yield about 63 gallons of oil. The residue, known as gingelly poonac, forms an excellent food for cattle. It is reported that in the Madras Presidency about a million acres is usually cultivated with Gingelly. The plant is also occasionally cultivated in Ceylon, more especially in the Northern Province. Very large quantities of the oil and seed are imported into Ceylon from India.

Oil Palm, African. (**Elæis guineensis*).—This important palm is a native of West tropical Africa, where it forms one of the principal commercial products of the country, and occurs over enormous areas, both naturally and cultivated, more especially in Southern Nigeria. The fruit supplies the Natives with a favourite article of food, from the stem they extract an intoxicating drink, while with the leaf-stalks and leaves they build and thatch their houses. The fruit kernels, which are of the size of almonds, yield a valuable commercial oil, and are largely exported on this account. The present annual exports of oil and kernels from the Gold Coast are valued at about £200,000. The oil-palm grows to 50 or 60 feet in height, with a straight trunk, bearing a crown of large handsome pinnate leaves. It has been successfully introduced into various parts of the tropics, its introduction into Peradeniya Gardens dating from 1850. Here it grows luxuriantly and bears fruit annually. It thrives best in a rather moist stiff soil, especially in

* See *Bulletin of the Imperial Institute*, 1909, Vol. VII, No. 4, and *Kew Bulletin*, 1892.

sheltered valleys. In its native country it begins to bear fruit in its fifth or sixth year, the produce increasing until its fifteenth year, and continues fruitful for at least sixty years. A full-grown tree is said to produce, on an average, from 6 to 12 bunches of fruit every year, an average-sized bunch containing about 200 nuts. The fruit has a fleshy fibrous outer layer, from which the ordinary palm-oil of commerce is obtained. Distinct from this is the white-oil, known as nut-or kernel-oil, obtained from the kernel. The former is used chiefly in the manufacture of soap and candles, while the kernel oil is used largely for making margarine or artificial butter. The Natives extract the coarser oil by boiling the fruits in earthenware pots, the kernel oil being generally expressed in Europe by hydraulic presses; the resulting cake affords a valuable cattle food. A single tree may yield from 1 to 3 gallons of oil per annum, the quantity varying according to rainfall and the character of the soil. The price of palm-oil on the London market varies from about £30 per ton, against £35 to £40 for Coconut oil f.o.b. Colombo. The palm is propagated by seeds, which take 2 to 3 months to germinate.

Sun-flower Oil. (*Helianthus annuus.* Compositæ).—Sunflower-oil is an important article of commerce, being obtained from the seed of the familiar annual plant of the same name; while the seed is a nutritious food for cattle and poultry. The plant, originally a native of Peru, grows 5 to 6 ft. or more in height, and thrives in ordinary soil in any warm climate with sufficient moisture. In Ceylon it flourishes at all elevations, more especially from 3,000 to 5,000 ft. It is extensively cultivated in Russia for its edible seed as well as for its useful edible oil. The seed may be sown in rows 2½ ft. apart, allowing about 1 ft. between the plants in the rows. About 6 lb. of seed is thus required to sow an acre; a crop is obtained in four months from the date of sowing, and a yield of 50 to 60 bushels of seed per acre is considered a good return. The soil between the rows should be forked up or tilled occasionally in the early stages of the crop. The method of harvesting is similar to that of Maize, the heads being gathered and dried, then threshed or rubbed out by hand over a rough grating. The seed is said to be usually worth about £17 per ton for the purpose of extracting the oil. A bushel of seed, on an average, is estimated to yield a gallon of oil.

Shea Butter. (*Butyrospermum Parkii* Sapotaceæ).—A medium-sized tree with a stout trunk, bearing thick oval leaves, about 9 in.

long, 3 to 4 in. broad, and crowded at the tips of the branches. The large fleshy "nuts" (seeds), of which each fruit contains only one, yields a large percentage of stearine fat, which is suitable for candle and soap manufacture. This has been valued by the Imperial Institute at about £27 per ton, i.e., approximately the same as soft palm-oil (*Elæis*). The tree was introduced at Peradeniya Gardens in 1898.

OTHER IMPORTANT OIL-YIELDING PLANTS OF THE TROPICS.

[See also *Standard and Minor Products of Ceylon*].

Those marked * are indigenous to or common in Ceylon.

Botanical & Common Name.	Natural Order & descriptive notes.	Parts from which extracted.	Principal uses.
***Aleurites triloba.** Candle-nut or Bankul oil	*Euphorbiaceae* A tall tree, naturalised in Ceylon	Fruit kernels	Varnishes, lacquer, soap-making, etc.
***Amoora Rohituka.** "Hingul," *S.*	*Meliaceae.* A moderate-sized tree of Ceylon, India, etc.	Seed	Lighting.
***Anacardium occidentale.** Cashew-nut oil	*Anacardiaceae.* A spreading tree	Fruit	Antiseptic, etc.
Arachis hypogæa. Ground-nut oil	*Leguminosae.* A low annual	Seed	Culinary and soap-making. See *Tropical Vegetables.*
Argania sideroxylon. Argan-oil	*Sapotaceae.* Medium-sized tree of Morocco	,,	Culinary.
***Azadirachta indica.** Margosa oil: "Kohamba-tel	*Meliaceae.* A small tree of Ceylon and India	,,	Medicine and lighting.
†**Bassia latifolia.** Mahwa-oil	*Sapotaceae.* A large tree of Central India	,,	Lighting, culinary, soap, etc
***B.—longifolia.** "Mee-tel," *S.*	A large tree of the dry region Ceylon	,,	,, ,
***Brassica juncea.** Mustard-oil	*Cruciferae.* A small annual	,,	Culinary, medicine, etc.
***Calophyllum Inophyllum.** "Domba-tel," *S.*	*Guttiferae.* Medium-sized tree of Ceylon, etc.	,,	Medicine and lighting.
***Canarium zeylanicum.** "Kekuna-tel," *S.*	*Burseraceae.* A large tree, peculiar to low-country of Ceylon	Seed; gum-resin from bark	Fumigation, lighting, etc.
***Cinnamomum zeylanicum.** Cinnamon oil	*Lauraceae.* A large tree	Bark & roots	Medicine, antiseptic. See *Spices.*
***Cocos nucifera.** Coconut oil	See *Standard Products of Ceylon*	Nut	Lighting, lubricating, culinary, medicine.

[*S.* = Sinhalese].

† Samples of seeds have recently been valued at the Imperial Institute at £12. per ton.

Botanical and Common Name.	Natural Order & descriptive notes.	Parts from which extracted.	Principal uses
*Cymbopogon citratus. Melissa-or Lemon-grass oil	A perennial grass	Leaves	Medicine and perfumery.
*C.—nardus var. Citronella; Citronella oil: "Pangiri," *S.*	..	..	Medicine, soap-making, &c.
C.—muricatus. "Cus cus" grass; Vetiver-oil	..	Leaves and roots	Perfumery. Roots made into mats, or ground into powder and used to keep away moths.
C.—Schœnanthus. Geranium-, Rusa-, or Palmarosa-oil; Ginger-grass	..	Leaves	Perfumery, etc.
*Dipterocarpus glandulosus. "Dorana-tel." *S.*	*Dipterocarpeae.* Tall erect tree	Resin exuded from stem	Medicine.
*Eucalyptus globulus. Blue-gum; Eucalyptus oil	*Myrtaceae* A tall tree of Australia	Leaves	Medicine, antiseptic.
Eugenia caryophyllata. Clove-oil	*Myrtaceae.* A small erect tree	Cloves	Medicine, antiseptic.
*Garcinia echinocarpa. "Madol-tel," *S.*	*Guttiferae.* Small tree, peculiar to Ceylon	Seed	Medicine.
*Gossypium vitifolium, and other spp. Cotton-oil	See under *Fibres*	..	Culinary.
Guizotia abyssinica. Rantil or Niger-oil	*Compositae.* Small annual, cult. in India	..	Culinary, medicine, etc.
Gynocardia odorata. Chaulmugra-oil	*Bixaceae.* Large tree of Sikkim, etc.	Bark & seed	Medicine.
*Isonandra grandis. "Mihiria-tel," *S.*	*Sapotaceae.* Medium-sized tree; Ceylon only	Seed	Culinary, lighting & medicine
Jatropha Curcas. Physic-nut. Pulza-oil	*Euphorbiaceae.* A well-known shrub	..	Burning, etc.
*Kokoona zeylanica. Kokuna-oil	*Celastraceae.* Large tree of Cey. & S. India	..	Lighting & medicine.
Melaleuca leucadendron. Cajuput-oil; "Tea Tree"	*Myrtaceae.* Tall tree of Australia	Leaves and branches	Medicine, antiseptic.
Olea europea. Olive-oil	*Oleaceae.* A small tree	Fruit	See *Sub-Tropical Fruits.*
Pogostemon Patchouli. Patchouly-oil	*Labiateae.* A perennial herb	Foliage	Perfumery and soap-making.
Quillaja saponaria. Soapbark-oil	*Rosaceae.* A small tree of Chili	Bark	Bark saponine, yields "vegetable soap;" also used in medicine.
Santalum album. Sandalwood-oil	*Santalaceae.* Small tree of Cent. India	Wood	Perfumery, antiseptic; whole tree fragrant.
Sapindus saponaria. Soap-berry oil	*Sapindaceae.* Small tree of Jamaica	Covering of seed	Saponaceous seed.
*Schleichera trijuga. "Kon-tel," *S.* Macassar-oil	*Sapindaceae.* Large tree of Cey., Ind. & Java	Seeds	Medicine, etc.

[S.=Sinhalese].

FIBRES.

Bowstring Hemp; Niyanda, *S.* (*Sansevieria zeylanica.* Hœmadoraceæ).—A herbaceous stemless plant, with succulent, rigid, somewhat cylindrical, furrowed leaves, blotched with grey and attaining a height of $2\frac{1}{2}$ to $3\frac{1}{2}$ feet. From these a fine white tough and elastic fibre is obtained, which is used by the Natives for weaving into fine mats, also for bow-strings and twine. The plant is indigenous to Ceylon, India, etc., being found in rocky or sandy places, chiefly in rather dry districts at low or intermediate elevations. It thrives, however, in a moist climate up to 2,000 feet or more. The plant is readily propagated by seed, division, or leaf-cuttings, the latter being the more convenient. It may be planted in rows about 2 feet apart each way, say, 10,500 plants to the acre, and the return of fibre is estimated at $1\frac{1}{2}$ tons per acre per annum, the fibre being usually worth in London about £30 per ton.

Broom corn, or Millet corn; "Idal-iringu" *S.* (*Sorghum vulgare.* Gramineæ).—A tall annual corn, cultivated throughout the tropics for its grain (see *Vegetables and Food Products*), while its panicles (inflorescence) are largely employed for making carpet brooms and cloth brushes. There is a good demand for the "fibre," which ranges in price from about £20 to £30 per ton or more according to quality. The cleaned fibre should be not less than 14 in. in length, and must not be coarse, stiff, or brittle; the colour should be pale with a green tint. An average crop is said to yield from 7 to 10 cwt. of clean fibre and from 10 to 12 cwt. of seed per acre. Sowing is done at the rate of about 6 lb. of seed per acre, the seeds being sown in rows 3 ft. apart; a crop should be obtained in about 5 months.

Jute, or Gunny-fibre.—This valuable fibre is obtained from the stems of species of *Corchorus* (N. O. Tiliaceæ), chiefly *C. capsularis* and *C. olitorius*, annual plants with long thin stems and yellow flowers, attaining a height of 8 to 12 feet, indigenous to Ceylon, India and Malaya. The cultivation and manufacture of jute forms a large industry in Bengal, where about two million acres are yearly under the product. The fibre is separated by retting the stems in water, and is extensively used for making cordage, coarse cloth, fishing nets, gunny bags, etc. A hot moist climate, followed by a dry season, suits the plant best. The crop is raised either from seed sown broadcast in the field, or from plants raised in nurseries and transplanted out into rows. Harvesting

takes place three months later, when the plants commence to flower. The Jute plants are indigenous to Ceylon, occurring at low elevations but are not cultivated here. Jute fibre is usually quoted in London at about £25 per ton.

Manila Hemp; Abaca Fibre. (*Musa textilis*, Scitamineæ).—A large herbaceous plant or small tree of the Banana family, indigenous to the Philippines, where it is extensively cultivated for its excellent and well-known fibre. The plant requires a hot and humid climate, with a heavy and evenly distributed

MAURITIUS HEMP. *Furcraea gigantea.*

rainfall, and its habit of growth and treatment under cultivation are similar to those of the Plantain or Banana. Hemp plantations in the Philippines are confined chiefly to areas of volcanic soil and possessing the climatic conditions mentioned, as in the eastern side of the Islands. Propagation is entirely by suckers (fertile seeds being rarely produced), which are planted out when about 3 feet high, at distances of 8 feet apart each way. These produce numerous stems (suckers), forming a clump. The first crop is obtained two years from planting, and a full crop in the fourth year, the plantation continuing to yield for fifteen or

twenty years. To obtain the fibre, the soft watery stems (formed by the leaf bases) are cut down just before they begin to flower (i.e., when they are best for fibre), about a foot from the ground being then stripped into ribbons; the latter are drawn repeatedly by hand between a blunt knife[1] and a hard smooth board, the fibre being then dried in the sun. The inner portion of the stem yields the finest quality of fibre. The usual return is said to be

NEW ZEALAND HEMP. *Phormium tenax.*

from 600 to 850 lb. of dry fibre per acre from the fourth year, or roughly 1 lb. per tree. With good cultivation the yield could, however, be increased to about 1,700 lb. per acre. The price of the fibre fluctuates somewhat from £25 to £35 per ton in London.

Mauritius Hemp; Green Aloe. (*Furcraea gigantea.* Amaryllideæ).—A large succulent stemless perennial, indigenous to Tropical America, bearing immense succulent leaves, 5 to 8 feet

or more in length. It has been introduced into Ceylon before 1824, and has become naturalised along the railway-line up-country, where it was first planted to form a boundary. It has become equally common in parts of India, where, however, as in Ceylon, no commercial use is made of the fibre. The yield of the latter is said to be only about 2 % to 3% as against 3 to 4½% in Sisal Hemp. The plant is similar in appearance, as well as in cultural requirements, to the latter, but is distinguished from it by the leaves being spiny along the margins towards the base.

New Zealand Flax. (*Phormium tenax.* Liliaceæ).—A handsome perennial bushy, stemless plant of New Zealand, having long sword-shaped leaves, which are either green or margined and streaked with white; the latter form is of an ornamental appearance and often grown for ornament. The leaves, rising from the base, measure from 5 to 7 feet in length, and give upwards of 15% of their green weight in cleaned fibre; the latter is of a silky lustre, nearly white in colour, "with a breaking strain higher than that of hemp or flax;" it is used for ropes, binder twine, and cordage. It is estimated that an annual yield of 12 to 15 tons of green leaves per acre may be obtained, furnishing from 1½ to 2 tons of clean fibre, which is said to be worth from £20 to £25 per ton. The plant grows freely at the higher elevations in the tropics, and has become quite acclimatized at Hakgala Gardens and neighbourhood; it is readily propagated by division of the rootstock or from seed.

Panama-hat Plant; Toquilla "Palm." (*Carludovcia palmata.* Cyclanthaceæ).—A stemless palm-like plant with large palmate leaves, similar to those of a fan-palm, with stalks 5 to 6 ft. long, growing naturally in clumps. The flowers, followed by the seed, are produced in cones borne on stalks rising from the base, from 1 ft. to 1½ ft. high. It is a native of Tropical America, and is extensively cultivated in parts of Eucador, Colombia, etc., for the sake of the leaves from which the well-known Panama hats are made. The plant is fully developed at about two to three years old, and the same clump lives for many years in the same ground. The young leaves are taken every month just as they begin to unfold, the stalk being cut some distance below the leaf to facilitate handling. Each leaf is torn into plaits about ½ inch wide (the outer plaits being rejected), and finally into shreds by means of an instrument consisting of a piece of wood in which needles are properly arranged. These shreds, constituting the "straw," are then

submerged in boiling water for some time, being afterwards bleached by sulphuring, then dried first in the shade and subsequently in the sun. At the present time the "straw" sells in its native country at from $\frac{1}{2}$ to $\frac{2}{3}$ of a dollar (say, 2*s.* to 2*s.* 9*d.*) per lb, the price having advanced considerably in recent years owing to the increased popularity of Panama hats in Europe. Some of the higher grade hats, being valued for fineness of fibre and excellent workmanship, commands as high as £5 each, some even fetching much higher prices. The Carludovica plant has been introduced into Peradeniya Gardens in 1866. It grows luxuriantly in a moderately moist, loose loamy soil, and prefers light shade, but the latter is not essential. A hot humid climate is indispensable.

Jippi-jappa Hats, which are similar to the Panama article, are made from the leaves of *Carludovica Jamaicensis*, a plant which closely resembles the preceding species.

Piassava Fibre or African Bass.—The fibre obtained by retting, and then beating, from the stems of the fronds of *Raphia vinifera* forms a valuable product in Liberia and other parts of W. tropical Africa, where the palm is indigenous. The fibre, which is used chiefly in making brushes, brooms, sweeping machines, etc., is usually valued at about £18 to £20 per ton in England. Over 3,000 tons are exported annually from Liberia alone.

Ramie; Rhea-fibre or China-Grass. (*Bœhmeria nivea.* Urticaceæ).—A perennial shrub of the Nettle family, 5 to 6 ft. high, with large heart-shaped leaves which are greyish-white beneath, indigenous to tropical and sub-tropical Asia. From the inner bark of the stems is obtained the rhea fibre of commerce, one of the most valuable of textile fibres; it is pure white, of a silky lustre, and is used in the manufacture of the finest linen, incandescent gas mantles, etc. The plant is easily grown, thrives best in a loamy, alluvial or humous soil up to 2,000 or 3,000 ft., and requires either a moist climate or irrigated land. No shade is necessary once the plants are established. These are readily propagated by division of the root-stock or by cuttings; they may also be raised from seed, which is very small. The soil being dug or ploughed to a depth of 7 or 8 inches, the plants may be planted about 2 by $3\frac{1}{2}$ ft. apart, in rows. A small crop of stems may be obtained in eight to ten months from the time of planting, and afterwards a yield of 3 or 4 cuttings a year. The production of straight clean unbranching stems is essential, as these furnish the best fibre.

About 30 tons of stems is an estimated annual yield per acre. One ton of stems produces about 150 lb. of prepared fibre, which is usually valued at £25 to £30 per ton in Europe, according to quality. The difficulty of obtaining suitable machinery for degumming and decorticating the fibre has long been an obstacle to the industry, but this is said to be now almost overcome. It is stated that a good field will not require replanting for five to six years, the plants being kept within proper limits by chopping the sides of the rows occasionally. The crop is an exhausting one; therefore manuring is essential, and all refuse and mulch should be returned to the soil.

Sisal Hemp interplanted with Cotton, Maha-illuppallama Experiment Station, Ceylon.

VARIETIES.—*B. nivea*, var *tenacissima* has smaller leaves (green underneath), and is suited to higher elevations than the above. *B. pulchra* has large handsome dark velvety-looking leaves, and is worth growing for ornament.

Sisal Hemp. (*Agave rigida*, var. *Sisalana*. Amaryllideæ)—A perennial stemless plant of the Amaryllis order, indigenous to Mexico and introduced into Ceylon in 1890. The plant furnishes a valuable fibre, known as Sisal-hemp, from its leaves; is extensively cultivated in parts of South America, Hawaii, German East Africa and, to a smaller extent, in parts

of India and elsewhere. It bears long, thick, succulent leaves, 4 to 6 ft. long, usually smooth-edged and with a terminal spine. The plant flowers at about its seventh or eighth year; in order to preserve the quality of the fibre, the pole or flowering scape should be cut at 4 ft. from the ground, all suckers being also removed. Each pole if allowed to grow will bear from 2,000 to 3,000 bulbils. The plant is suited to a dry or wet climate, and is considered to thrive best on a limestone formation. It flourishes, however, on almost any soil that is well drained, as may be seen from its progress in Peradeniya Gardens. Propagation

SISAL HEMP IN FIJI.

is by bulbils (produced by the flowering pole) or suckers, and on average soils the plants may be planted out at about 8 by 8 ft. apart. The first cutting of leaves takes place in the third or fourth year from planting; under favourable conditions this will average from 20 to 22 mature leaves per plant a year, yielding from 3 to $4\frac{1}{2}$ per cent. clean fibre. Subsequent cuttings may be made at intervals of about six months, until an average of about 160 to 180 leaves in all have been obtained from each plant; this will occupy a period of about eight years from the time of planting, and is estimated to afford a total crop of about $10\frac{1}{2}$ lb. of prepared fibre per plant, or about 7,000 lb. per acre.

The yield, however, is variously estimated. SIR DANIEL MORRIS' estimate is 60 lb. of fibre from 1,000 leaves, thirty-three leaves per plant, 650 plants to the acre; total yield, 1,200 lb. fibre per acre per annum. It has been found in Java that a return which falls below 650 lb. per acre is not remunerative under cultivation.

SACK OR BARK-CLOTH TREE. *Antiaris innoxia.*
Showing (left) suit of bark cloth and (right side) sheet of same.

The price of the fibre fluctuates from about £25 to £30 per ton, according to quality.

Sunn (or **San**) **Hemp;** "Hana," *S.* (*Crotalaria juncea.* Leguminosæ).--An erect annual, 4 to 5 ft. high, with bright yellow flowers, indigenous to tropical Asia generally and commonly occurring in the dry region of Ceylon. It is cultivated practically all over India, and to a small extent also in the

north or north-western districts of Ceylon, for the sake of the strong and useful fibre obtained from the stems by retting. It is also sometimes cultivated as a green fodder plant for cattle, as well as for green-manuring. In cultivation, seeds are sown thickly, either broadcast or in drills—generally broadcast if for fibre; the quantity of seed sown per acre varies greatly, from 12 to 80 lb. per acre. The plant is invariably grown as a catch-crop, not mixed with other products. In India the crop is sown with the beginning of the rains, and occupies the ground usually for four or five years, being cut when the plants blossom. In harvesting, the plants are usually pulled up by the roots, though sometimes cut close to the ground, and left on the field for a few days to wither; they are then stripped of the leaves and tied in bundles of about a hundred stalks. The bundles are dried for two or three weeks, then placed in pools (preferably of still shallow water) and weighted down with stones or wood logs; they are thus left for five or six days to ret. The fibre is afterwards stripped off, washed, bleached, and plaited into tails. A good average yield is considered to afford about 640 lb. (or 80 maunds) of clean fibre per acre. The price of the fibre varies greatly in India according to quality, from about Rs. 11 to Rs. 18 per cwt. The best grade is said to come from Bombay, and is about 4 ft. long. In London the fibre is said to be worth about £16 per ton. The chief use of the fibre in India is for making coarse canvas, cordage, and fishing nets. With cultivation, the plant may be grown on almost any soil, but a light rich soil is considered to suit it best, a clayey or inundated land being the least suitable.

OTHER IMPORTANT FIBRE AND TEXTILE PLANTS OF THE TROPICS.

[See also Chapters XXII & XXIII].

Those marked * are common or indigenous in Ceylon.

Botanical or Common Name.	Descriptive notes. Natural Order in Italics.	Purpose for which principally used.
Abroma augusta	*Sterculiaceae.* Perennial shrub of Ind. & Java	Cordage.
***Allæanthus zeylanicus.** "Alandu" *S.*	*Urticaceae.* A spreading tree, peculiar to Ceylon	Ropes, etc.
***Ananas sativum.** Pineapple fibre	*Bromeliaceae.* See *Tropical Fruits*	Textile fabrics.

[S.=Sinhalese]

Botanical and Common Name.	Descriptive notes. Natural Order in Italics.	Purpose for which principally used.
*Anodendron paniculatum. "Gerandi-dul," *S.*	*Apocynaceae.* Huge climber of Cey., Ind., and Malaya	Ropes.
Anona reticulata. Bullock's heart; "Anoda," *S.*	*Anonaceae.* Small tree of Trop. America	Fine lace-like fibre; wrappers, etc.
*Antiaris innoxia "Riti"; Sack Tree.	*Urticaceae.* Large tree of Ceylon & Moluccas	Bark-cloth.
Arenga saccharifera. Gomuti-fibre; Sugar Palm.	Large palm of Malaya	Ropes, brushes, etc.
Asclepias curassavica. Jamaica Ipecacuanha	*Asclepiadeae.* West Indian shrub.	Cordage.
Attalea funifera. Coquilla Nut; Piassaba, or Bass-fibre.	Handsome Brazilian palm	Bass brooms, etc.
Bauhinia racemosa. "Mayila," *S.*	*Leguminosae.* Small tree; Cey., Ind., Malaya	Ropes and cordage.
Borassus flabellifer. Palmyra-fibre.	Palmae. See "Minor Products of Cey."	Brooms, ropes, etc.
Broussonetia papyrifera. Paper Mulberry.	*Urticaceae.* Quick-growing tree of Burma and China	Tapa cloth, etc.
*Calotropis gigantea. "Wara," *S.* "Madar-fibre."	*Asclepiadeae.* Common shrub of Cey., India and Malaya	Ropes and cordage.
Cannabis sativa. Indian Hemp; Ganja, or Bhang.	*Urticaceae.* Annual shrub of Central Asia	Paper, textiles, etc.; also an important narcotic drug.
*Caryota urens. "Kitul," *S.*	Handsome bi-pinnate palm; Cey., Bengal, etc.	Brushes & brooms.
*Cocos nucifera. Coconut Palm.	See "Standard products of Ceylon."	Ropes, brooms, etc.
Cryptostegia grandiflora.	*Asclepiadeae.* Woody climber of India and Trop. Africa	,, ,,
*Debregeasia velutina. "Gas-dul," *S*; "Wild Rhea."	*Urticaceae.* Small tree of Cey., India & Java	,, ,,
*Grewia microcos. "Keliya," *S.*	*Tiliaceae.* Shrub; Cey., India & Malaya	Ropes.
*Gyrinops Walla. "Walla-patta," *S.*	*Thymelaeaceae.* A small tree, peculiar to Ceylon	Ropes and cordage.
*Helicteres Isora. "Liniya," *S.*	*Sterculiaceae.* Shrub of Cey., Ind. & Java	Cordage.
Hibiscus cannabinus. Deccan or Bombay Hemp.	*Malvaceae.* Shrub with prickly stem; India	Fishing nets, paper, etc.; largely cultivated in Java.
H.—elatus. Cuba-bast; Mountain Mahoe.	*Malvaceae.* Small bushy tree of West Indies	Cordage and mats
*H.—tiliaceus. "Beli-patta," *S.*	*Malvaceae.* Large shrub.	,, ,,
Honckenya ficifolia. "Bolo-bolo."	*Tiliaceae.* Annual shrub of trop. Africa	Cordage and mats; bronze-coloured leaves, ornamental.
Lagetta lintearia. Lace-bark Tree.	*Thymelaeaceae.* Small tree of West Indies	Lace-like inner fibre
*Lasiosiphon eriocephalus. "Naha," *S.*	*Thymelaeaceae.* A bushy shrub.	Ropes, etc.

[S.=Sinhalese]

Botanical and Common Name.	Descriptive notes. Natural Order in Italics.	Purpose for which principally used.
*Musa sapientum. Plantain or banana.	*Scitamineae.* See *Fruit Trees*	Ropes.
Pandanus utilis.	*Pandaneae.* Screw-pine; Madagascar	Baskets, mats, etc.
Raphia Ruffia. Raffia-bast.	Large feathery palm. of Madagascar	Mats, tying material; thin cuticle of leaf.
Sansevieria guineensis. Konje Hemp. S.—Roxburghiana. Murva or Moorva fibre.	*Haemodoraceae.* Herbaceous perennials, like Bow-string hemp of Ceylon	Fine mats, etc.
*Sesbania aculeata. "Dhaincha"	*Leguminosae.* Semi-woody annual; Ceylon, Tropics	Mats, etc.
*Sida rhombifolia. "Kotikan-bevila," S.	*Malvaceae.* Shrubby perennial. Tropics	Mats and cordage.
*Sterculia Balanghas. "Nava," S.	*Sterculiaceae.* A tree of Cey., India and Malaya	Ropes, etc.
Trachycarpus excelsus. "Chinese-coir or Hemp-palm."	*Palmae.* A small palm of China	Brushes & cordage.
*Triumfetta rhomboidea. "Epala," S.	*Tiliaceae.* Shrubby perennial. Tropics	Cordage, cloth, etc.
*Urena lobata. "Patu-epala," S.	*Malvaceae.* Shrubby perennial. Ceylon, etc.	Textiles & cordage.
*Villebrunea integrifolia.	*Urticaceae.* A small up-country tree of Ceylon and E. Tropics	Ropes, mats, etc.

Pith Plants, Ola, Etc.

Botanical and Common Name.	Descriptive notes. Natural Order in Italics.	Purpose for which principally used.
*Aeschynomene aspera. Shola; "Maha-diya-siyambala," S.	*Leguminosae.* A marsh shrub of Cey., Ind., Malaya, etc.	Floats for fishing.
*Corypha umbraculifera. "Tala-gas," S. Talipot Palm.	See under *Palms*	Umbrellas, fans, tents, &c. Young leaves used as ola for writing on.
Fatsia (Aralia) papyrifera. Rice-paper Plant of China	*Araliaceae.* Shrub, 8 to 10 ft.	Large palmate leaves; naturalised in some places up-country.
Herminiera elaphroxylon. Nile pith-tree.	*Leguminosae.* Small aquatic tree of Trop. Africa	Sun-hats, &c.
*Scævola Kœnigii. "Takkada," S.	*Goodenoviaceae.* Large bush of Cey. & E. Tropics	Sun-hats, floats, etc.

[S.=Sinhalese].

TANS

Divi-divi Pods; "Vanni," *T.*—The fruit of *Caesalpinia coriara* (Leguminosæ), a moderate-sized spreading tree with finely pinnate leaves and sweet-scented flowers, native of Central America and the West Indies. The tree has been introduced into Ceylon, and thrives up to 2,000 feet, in moist as well as in moderately dry districts, being especially suited to the latter. In the Trincomalee district, with an annual rainfall of about 63 inches, the tree has been planted some years ago as a commercial product, and its growth is reported to be satisfactory. Divi-divi is cultivated in certain parts of South America, more especially in the Island of Curazao. Seeds are best sown in baskets; the seedlings should be ready for planting out about five months after germination, and may be planted at distances of about 16 ft. apart each way. In course of time it may become necessary to thin the trees out further, an average space of 26 ft. apart each way being finally allowed, or say 64 trees to the acre. The small twisted pods are picked when fully ripe, the proper condition being indicated when the seed can be heard to rattle in the pods. The best are exported as *first quality*, all fallen pods being classed as *second quality*. The yield per tree may be from 40 lb. to 80 lb. annually, only one crop a year being produced. Divi-divi pods are a valuable tanning material, and are largely exported from South America, and to some extent from the West Indies. They are usually valued in England at from £9 to £11 per ton.

Gambier; Terra Japonica. (*Uncaria Gambier*. Rubiaceæ). —A large climbing shrub, native of Malaya, where it is sometimes cultivated as a catch-crop with Pepper. An astringent extract, called "cutch," and used by tanners and dyers, is obtained by boiling down the leaves and shoots; it is exported and commands about 37*s*. per cwt. in London. Cutch is commonly used in Malaya as a chewing mastic, and commands an average price of about 6 dollars per picul. The Gambier plant has been introduced into Ceylon in 1887, and flourishes in the moist heat of Heneratgoda Gardens, near sea level. It is probably unsuited for cultivation above 1,000 feet elevation.

Wattle Bark.—The bark of several species of Acacia are described as "the best of Australian tan barks, and among the richest tanning barks in the world." The more important of these are: Black or Tan-wattle (*Acacia decurrens* var. *mollissima*), Silver-wattle (*A. dealbata*), (Blackwood or green-wattle (*A. Melanoxylon*), and

Golden or Broad-leaved wattle (*A. pycnantha*). All these and other wattles or Acacias have been introduced into Ceylon and established at elevations of 4,000 to 6,000 feet. A few years ago Mr. KELLOW, of Albion Estate (elevation about 4,500 ft.), disposed of a large quantity of the bark of *Acacia decurrens* for use by tanners in Colombo, at about Rs. 140 (£ 9. 5.) per ton. Wattles are also cultivated in India, South Africa, etc. Of Black-wattle bark large quantities have of late years been exported from Durban. Apart from the bark, most of the wattles afford excellent timber. The small compressed seed is extremely hard, and should be soaked in almost boiling water for at least twenty-four hours previous to sowing. A pound contains from 30,000 to 50,000 seeds. Seedlings are best raised in baskets or joints of bamboo or reed; the tall grass *Arundo Donax* affords useful reeds for this purpose. The cultivation of Wattle-barks is very simple. They thrive in almost any barren soil, provided there is sufficient depth for the initial roots to penetrate. The plants should be planted about 12 to 15 feet apart. The bark may be profitably peeled from trees six to eight years old, and an average yield of 28 lb. per tree may be expected at this age. Full-grown trees supply the best quality, and yield as much as one cwt. of bark, very large trees giving even more. In Australia, the cost of stripping the bark now varies from £2 to £2. 5*s*. per ton. To obtain the bark, the trees are cut down and stripped at once. Wattle-bark has in recent years dropped in price and fetches at present from £6 to £8 per ton, according to quality.

OTHER IMPORTANT TANNING PLANTS.

Botanical and Common Name	Native Country, etc.	Parts from which tannin is obtained.
Acacia Catechu. Cutch; Catechu.	N. India, Burma, etc. A small tree.	Heart-wood and pods.
Areca Catechu. Arecanut; "Puwak," *S.*	Malaya. An erect, slender palm.	Seeds. See *Minor Prod. of Ceylon.*
Careya arborea. Patana Oak: "Kahata," *S.*	Ceylon, India, etc. A small tree.	Bark astringent; much used for tanning
Cassia auriculata "Ranawara," *S.* Matara Tea.	Ceylon, and India. A quick growing large shrub.	Bark largely used by tanners in Colombo.
Diospyros Embryopteris. "Timbiri," *S.*	Ceylon, India, and Malaya. Medium-sized tree.	Unripe fruits astringent, commonly used for tanning fishing nets

[S.=Sinhalese]

Botanical and Common Name.	Native Country, etc.	Parts from which tannin is obtained.
Mimusops hexandra. "Pallu," *S.*	Ceylon and India. Moderate-sized tree.	Bark.
Phyllanthus Emblica. "Nelli," *S.*	Ceylon, India, Java, etc. Small shrub or tree.	Fruits.
Rhizophora mucronata "Kadol," *S*; "Kandal," *T.* **Ceriops Candolleana.** } Mangrove barks	Ceylon and Eastern Tropics. Moderate-sized spreading trees, inhabiting lagoons	Bark and extracts used for tanning and dyeing.
Rumex hymenocepalus. "Canaigre"	Mexico. A tuberous perennial.	Tuberous roots.
Terminalia belerica "Myrobolan; Bulu," *S.*	Ceylon, India, Malaya. A very large tree.	Fruits.
T.—Chebula, "Aralu," *S.*	Ceylon, India, Malaya. A moderate-sized tree.	,,

VEGETABLE-WAX, GUMS, RESINS, Etc.

Candellila Wax.—This vegetable wax is obtained from *Euphorbia antisiphyllitica* (N. O. Euphorbiaceæ), a small plant, native of Mexico, which produces a considerable quantity of the wax in a thin coating over all parts of the stems and branches. In America the wax is classed with bees-wax in quality; having a high melting point, it is claimed to be superior to Carnauba palm wax, and is said to be in good demand in London. The wax is obtained from plants growing wild in Mexico in arid regions, those in moist districts furnishing little or none; it is extracted by a simple process of boiling, by which a yield of about 3% to 4% of wax (of about 90% purity) is obtained. Candellila wax is used at present in the manufacture of shoe polishes, floor waxes, varnishes, carbon papers, gramophone records and for electrical insulation, etc. It sells for about 1s. per pound delivered in Europe. The Candellila plant (signifying "little candle") is easily propagated by cuttings. The name is also applied to *Pedilanthus Pavonis*, another Euphorbiaceous shrub of North Mexico, 2½ to 4 ft. in height.

Carnauba Wax.—A product of the Brazilian Wax-palm (*Copernicia cerifera*), a moderately-large, handsome palm, 30 to 40 ft. high, found in abundance in the forests of Brazil. On the underside of the leaves is deposited a thin layer of wax, which is collected either by gathering the leaves and exposing them in a dry place to wither, when the wax cracks and peels off in flakes, or by scraping the wax from the leaves, it being afterwards melted and poured into moulds. Another mode of collecting is by

cutting the leaves into pieces and boiling them in water, when the liquid wax rises to the surface, and is skimmed off. The leaves are cut twice a month, in the dry season, and about six to eight leaves are obtained yearly from one palm. It is said that it takes 3,500 leaves to yield 34 lb. of wax. The collection of the latter is an important industry in Brazil, where the annual export of the article is said to amount to about 2,000 tons, valued at £200,000. Carnauba-wax is an article of high commercial value. It has been used during many years past for the manufacture of fine-quality candles, also as a basis for boot-polish. Recently it has been found to be the most suitable substance for the manufacture of phonograph and gramophone records, and the additional demand thus created has had the effect of materially increasing the value of the wax, which at present is quoted in London at 100*s*. to 110*s*. per cwt. The value of the wax is dependent upon three factors viz., tint, texture, and richness in oil. For trade purposes it is graded into three qualities; the best quality is of uniform pale-cream tint, smooth and homogeneous in texture and rich in oil, the inferior grades being darker and less uniform in colour, somewhat porous in texture and less rich in oil.

Wax-palm of New Greneda. (*Ceroxylon andicola*).—This differs from the preceding tree, in that the wax is deposited on the trunk and not on the leaves. The palm is also suited to a higher elevation and cooler climate than the Brazilian species ; it thrives in a sheltered spot in Hakgala Gardens, Ceylon, where it has been introduced about 25 years ago. It grows to about 30 ft. in height, and the trunk is usually distended half way up. The wax, which is deposited between the leaf-scars on the trunk, often so thick than it can be removed in flakes, forms an article of trade in New Greneda, and is used for making candles. The average yield per tree is said to be about 25 lb.

Vegetable (or Chinese) Tallow.—A product of *Sapium sebiferum* (Euphorbiaceæ), a small tree, 25 to 30 feet high, native of China and Japan. The fatty matter obtained from the layer surrounding the seed is used in China in place of animal tallow for the manufacture of candles and soap, also in cloth-dressing. A brownish yellow oil is obtained from the seed kernels, which is used as a burning-oil, and also in the preparation of varnishes, on account of its dyeing properties. A mixture of the oil and fat is stated to be a good substitute for lard used for industrial purposes. Vegetable-tallow is exported from China to Europe, etc., in hard

white cakes, weighing about $\frac{1}{2}$ cwt. each. The tree is said to be cultivated on a large scale in China. It has been introduced into Ceylon before 1824, and grows freely at elevations over 4,000 feet. It has become naturalised at Hakgala Gardens, where it seeds abundantly.

Ivory-nut Palm, or Corozo-nut (*Phytelephas macrocarpa*). A slow-growing palm, with handsome pinnate erect leaves, 10 to

IVORY-NUT PALM (MALE), SHOWING INFLORESCENCE.

15 feet long, indigenous to Central America. It has been introduced at Peradeniya Gardens in 1850, and has flowered and fruited here at irregular intervals during the last 15 years. For many years stemless, the palm forms in time a short prostrate stem. It is diœcious (male and female flowers being borne on different plants), so that it is necessary to have a plant of both sexes in order to

obtain fertile seed. The large whitish seeds (contained in large round clusters of spiky fruits, produced at the base of the palm) become very hard as they ripen, and are known as "vegetable ivory." They are in demand for making superior buttons, articles of ornaments, etc., and are said to command at present about 34*s*. per cwt. The source of supply is confined to Central America, and the annual average production is about 48 million pounds, all of which is exported.

IVORY-NUT PALM (FEMALE), A.—FRUIT CLUSTER.

Other palm seeds are also used to some extent as vegetable ivory, as the *Raphia vinifera* of West Africa and the Coquilla-nuts (*Attalea funifera*) of Brazil. The seeds of the Talipot Palm (*Corypha umbraculifera*) are commonly worked into buttons and articles of ornament in Ceylon.

Chicle Gum, or Zapote Chico.—The milky juice of the tree *Achras Sapota* or "Sapodilla" (N. O. Sapotaceæ), obtained from

incisions made in the bark. At first the latex is white, but it rapidly becomes yellow and coagulates on exposure to the air. This forms the basis of the chewing gum of commerce, so largely used in America, being scented and flavoured with mint, vanilla and other ingredients. The production of chicle gum in Mexico is said to be a prosperous, though a small, industry; the amount yearly exported, chiefly to the United States, being about 2,200 tons. The article is also exported from British Honduras. See under *Tropical Fruits*.

OTHER SOURCES OF GUMS, RESINS, VEGETABLE-WAX, GAMBOGE, ETC.

Botanical and Common Name.	Native country, etc.	Nature of product and how obtained.
Acacia arabica. Gum-arabic	N. India, Arabia & Soudan. Small tree.	Gum exudes from branches, sometimes assisted by incisions.
Canarium strictum. Black Dammar	India. A large tree	Resin obtained by incising and firing base of tree.
C.—zeylanicum. "Kekuna," *S.*	Ceylon only. A large tree; low-country.	A fragrant gum-resin exudes from base of trunk.
Copaifera Landorffii. Balsam of Copaiba.	Brazil. A large tree	Balsam or gum-resin obtained from a stem.
Doona zeylanica. "Dun," *S.*	Ceylon. A tall tree.	A fragrant gum-resin exudes from base of trunk.
Garcinia morella. Gamboge; "Gokatu," *S.*	Ceylon, India, etc., A small tree.	Yellow gum or gamboge, exudes from stem.
Guaiacum offinale. Lignum Vitae.	Trop. America. A small very slow-growing tree	A green resin is obtained from incisions in trunk or by heating portions of the wood.
Hymenaea verrucosa. Copal resin	Madagascar. A tree 40 ft. high.	Resin obtained from bark incisions.
Liquidambar orientalis. Liquid Storax.	Asia Minor; tree 40 ft. high	Resin obtained from inner bark by boiling in water.
Myroxylon Pereirae. Balsam of Peru	Trop. America; large tree.	Exudation of gum resin from base of tree.
Odina Woodier. "Hik," *S.*	Ceylon, India, Java, etc. Small tree.	Gum obtained from stem.
Pistacia Terebinthus. Turpentine Tree.	Asia Minor, Mediterranean. Small tree.	Oleo-resin obtained by incisions in bark.
P.—Lentiscus. Mastic.		
Pterocarpus marsupium. "Gammalu," *S.* "Kino."	Ceylon & S. India, A tree 50 ft. high.	Gum-resin exudes from bark.
Raphia ruffia. Raffia Palm.	Madagascar. A palm with large feathery leaves.	Wax obtained by beating dried leaves on mats.
Rhus succedana. Japan wax.	China, Japan, etc. A small tree.	Wax deposits on fruits obtained by boiling.

[S.=Sinhalese].

Botanical and Common Name.	Native Country, etc.	Nature of Product and how obtained.
Vatica Roxburghiana. "Mendora," *S.*	Ceylon and S. India A tree 50 ft. high	A clear yellowish resin exudes abundantly from the stem.
Vateria acumina'a. "Hal," *S.*	Ceylon only; large handsome tree.	
V.—indica. Indian copal or White dammar.	S. India. A moderate sized tree.	

IMPORTANT DYE PLANTS

Annatto.—See *Minor Products of Ceylon.*

Henna; Tree-Mignonette; Marithondi, *T.* (*Lawsonia alba.* Lythraceæ). A deciduous much-branched shrub, indigenous to Western India, Persia, etc., and to the dry region of Ceylon; commonly cultivated throughout Egypt, Persia, India, etc., for its small oval leaves, which yield the "henna" dye, also as a garden hedge plant. A crop of leaves is reaped in the second year from planting, two crops a year being afterwards obtained for many successive years. At each cutting about 9 inches are taken from the top shoots, an acre thus yielding about 20 maunds of dry leaves a year. The leaves are dried and reduced to a powder which, made into a paste with water, is very commonly used by Mohammedan, and to some extent Hindu, women as a cosmetic for staining the eye-brows, finger-nails, hands, feet, etc., a dull orange-yellow; also used sometimes for dyeing the hair a red colour. This use of henna dates back from very ancient times.

Indigo. "Nil-awari," *S.*—A blue dye obtained from several species of *Indigofera*, chiefly *I. arrecta*, *I. sumatrana*, *I. anil* and *I. guatamalensis.* All are shrubby plants, annual or perennial, 2 to 4 ft. high, belonging to the Leguminous family. Numerous species occur in a wild state in Ceylon up to about 2,000 feet, but chiefly in the dry country. India and Java are now almost the only indigo-producing countries. Owing to the introduction of synthetic indigo in 1880, the cultivation of the natural article has become unprofitable in many localities, and consequently largely abandoned. Of late, however, the industry appears to have somewhat recovered, the natural indigo, which is claimed to have better dyeing properties than the synthetic, being preferred by many manufacturers. More profitable species of Indigofera have also been discovered in recent years, yielding a much larger percentage

of indigotine, the dyeing principle in indigo. *Seet*, the refuse mould left after the extraction of indigo, being rich in nitrogen and potash, is now regarded as a valuable manure and forms an important bye-product. 70 tons of green plant is estimated to yield about 3 tons of seet. The best condition for the profitable cultivation of the plant are a rich loamy soil with a free subsoil, and a moist hot atmosphere, with a fairly equally divided rainfall not under 70 in.; a temperature below 60° Fah. is unfavourable to the crop. The land being ploughed and harrowed, the seed is sown in lines about 2 feet apart; the seed being small, 10 to 15 lb. is required to sow an acre. It germinates in three or four days, and about three months later the flowers appear, when the plants are ready for harvesting. The plants are usually cut down to within about 6 inches from the ground, tied up in bundles, and carried fresh to the factory. The stumps left in the ground will afterwards "rattoon," and two, or in favourable circumstances as many as four, cuttings may be obtained from the same roots within the year. To produce the dye, the green crop is placed in large masonry tanks and there subjected to a process of fermentation and churning. The freshly cut material is weighted down with planks, and water laid on so as to cover the whole. Fermentation sets in and is allowed to go on for 12 to 16 hours, being stopped when the leaves become a pale colour. The liquid is run off by means of a tap at bottom of the tank, into a second tank or cistern, and is kept constantly agitated by either wading coolies, who beat with paddles, or by a mechanical contrivance, for two or three hours, after which the indigo settles in the bottom in the form of bluish mud. This, after draining off the water, is put into bags which are hung to dry, being afterwards cut into cubes about 3 in. square, stamped and further dried for export.

Yield.—The yield is variously stated at about 20,000 lb. green crop per acre for the first cutting, subsequent or rattoon cuttings giving much less. About 40 lb. of indigo paste may be obtained from 1,000 lb. green plant, and an outturn of 400 to 600 lb. standard paste per acre is considered a good average yield. Approximately 100 lb. green plant should give 3 to 4 lb. paste. The latter commands about 10*d*. to 1*s*. per lb. in London.

Logwood.—(*Haematoxylon Campechianum*. Leguminosæ).—A small slow-growing tree, native of Central America, but introduced and completely naturalised in several West Indian Islands. The heart-wood as well as the roots are extensively exported for

the extraction of log-wood dye, which is valuable in the manufacture of woollen and silk goods, and for numerous other purposes in the arts and sciences. The tree has been introduced in 1845 at Peradeniya, where it has made but slow growth. It is considered to thrive best in a hot and arid climate. Propagation is by seed; the seedlings may be planted out about 15 by 15 feet apart, or about 200 to the acre. At the age of ten years the trees are ready for felling; the sap-wood, being valueless, is chipped off and discarded, and the heart-wood, which is brownish-red, is made up in bales for export, or used for the extraction of dye locally, as is done in Jamaica.

Sappan-wood. See *Minor Products of Ceylon.*

Turmeric.—See under *Spices.*

OTHER IMPORTANT DYE PLANTS

Botanical and Common Name.	Native country, etc.	Parts from which dye is obtained, etc.
Artocarpus integrifolia. Jak; "Kos," *S.*	India. A large tree	Heart-wood; yellow dye.
Carthamus tinctoria. Safflower.	India (?). An annual, 2 to 3 ft. high	Dried flowers; red and yellow dye.
Chlorophora tinctorius. Fustic.	Central America. A large tree	Wood; a yellow dye.
Hedyotis umbelleta.	See *Oldenlandia*	
Hibiscus Rosa-sinensis. Shoe-flower.	India, etc. Tall shrub.	Flowers; a red dye, used in cookery, etc.
Nopalea coccinellifera.	Mexico	Coccid. Cochineal Cactus.
Nyctanthes Arbor-tristis. Night-flowering Jasmine. "Sepalika," *S.*	Central India. A large shrub	Flowers yield a yellow dye, used in India for dyeing cotton cloth, etc.
Oldenlandia umbellata. Indian madder; Chaya-root; "Saya," *S.* "Chaya," *T.*	Cey. & India. Small annual; sea coast, dry region	Pinkish-purple dye obtained from root; once a Ceylon Government monopoly.
Opuntia coccinellifera and C Tuna. Cochineal Cactus.	Mexico	A bug (*Coccus Cacti*) which feeds on the plant in enormous numbers.
Pterocarpus santalinus. "Red-sanders."	India. A small tree	Heart-wood affords a red brown dye, used for dyeing woollen cloths.
Semecarpus Anacardium. Marking-nut.	India, Malaya, etc. A moderate-sized tree.	Juice of nut mixed with quicklime is used for marking linen, etc.

GUTTA-PERCHA AND BALATA

Gutta-percha.—A substance similar to rubber, being a product of a certain group of trees (of the N. O. Sapotoceæ) which are chiefly indigenous to the Malay Archipelago, and obtained in the

form of latex by a method of tapping or ringing the bark. Felling the trees and ringing the bark is the usual method resorted to; consequently the trees have become scarce. In recent years, however, this depletion is reported to have been somewhat obviated by planting up the trees in forests and reserves. It is computed that an average yield of 16 lb. of gutta per tree may be obtained from trees in the wild state. Unlike rubber, gutta softens or melts in moderate heat. Its principal use is for insulating cable wires, etc., but it is also largely employed for making soles for boots and shoes. The following are the principal gutta-yielding trees:—

Palaquim (*Dichopsis*) *Gutta*, known as "Taban Gutta," or "Taban Merah;" *P. Maingayi* ("Gutta-Tabban Simpoo"); *P. pistulata* ("Gutta-Taban Puteh"); *P. obovata* and *P. Treubii*. *P. grandis* ("Kiri-hembiliya," S.), is indigenous to the moist low-country forests of Ceylon. *Payena Leerii*, introduced to Ceylon in 1880, and now established at Peradeniya and Heneratgoda Gardens, yields the Gutta Sundete, while "Gutta Singgarip" is obtained from the climber or liane known as *Willughbeia firma*.

Balata is a product analagous to gutta-percha, obtained chiefly from *Mimusops globosa* or "Bully-tree," belonging to the same family as *Palaquium* and found chiefly in Venezuela and British and Dutch Guiana, whence the article is exported. In the Guianas, the balata is sun-dried into sheets, while in Venezuela the latex is boiled and made into block balata, which commands about 6*d*. per pound less in the market than sheet balata. The latter usually fetches about 3*s*. 6*d*. per lb. Balata has considerable powers of wear and resistance, and is used for belting, water-proofing, etc.

IMPORTANT TIMBER AND CABINET WOODS OF THE TROPICS

Common and Botanical name.	Natural Order.	Native country, etc.
Black-wattle. Acacia decurrens var. Molissima.	*Legiminosae*	S. Australia.
Black-wood. A.—melanoxylon	"	"
Billion Eusideroxylon Zwagerii	*Lauraceae*	Borneo.
Brazilletto-wood. Peltophorum Linnæi	*Leguminosae*	West Indies.
Calamander. Diospyros quaesita	*Ebenaceae*	Ceylon.
Cam-wood. Baphia nitida	*Leguminosae*	West Trop. Africa.
Chittangong-wood. Chickrassia tabularis	*Meliaceae*	Burma.
Coffin Tree. Machilus namnu	*Lauraceae*	China. Esteemed for making coffins.
Dattock. Detarium guineense	*Leguminosae*	Tropical Africa.

Common and Botanical name.	Natural Order.	Native country, etc.
*Ebony, Ceylon. Diospyrus Ebenum	*Ebenaceae*	Ceylon.
—, Jamaica; Cocos wood. Brya Ebenus	*Leguminosae*	Jamaica and Cuba.
—, Malabar. Diospyrus melanoxylon	*Ebenaceae*	S. India.
Gammalu, *S.* Pterocarpus marsupium	*Leguminosae*	Ceylon and India.
Green-heart. Nectranda Rodioei	*Lauraceae*	West Indies.
Hal-milla. See Trincomalie-wood	—	—
Indian Red-wood. Soymida febrifuga	*Meliaceae*	Central India, etc., said to be immune to termites.
Iron-bark, Australian. Eucalyptus Leucoxylon; several other species	*Myrtaceae*	New South, Wales, etc.
Iron-wood, Ceylon. Mesua ferrea	*Guttifereae*	Ceylon.
Jak-wood. Artocarpus integrifolia	*Urticaceae*	India, Ceylon, etc.
Jarrah. Eucalyptus marginatus	*Myrtaceae*	West Australia.
Lignum Vitae. Guaicum offiicinalis	*Zygophyllaceae*	Tropical America.
Mahogany. Swietenia Mahogani	*Leguminosae*	Trop. S. America.
—, African. Khaya senegalensis	*Meliaceae*	West Trop. Africa.
—, Australian. See Jarrah	—	—
—, Bastard. Andira inermis	*Leguminoseae*	Trop. America, etc.
—, Indian. Cedrela Toona	*Meliaceae*	India, Java, etc.
—, Swamp. Eucalyptus robusta	*Myrtaceae*	Australia.
Milla. *S.* Vitex altissima	*Verbenaceae*	Ceylon and India.
Mirabow. Afzella palembanica	*Leguminosae*	Borneo and Malaya.
Mora. Dimorphandra mora	,,	British Guiana.
Mosquito-wood. Mosquitoxylon jamaicense		West Indies.
Mountain Mahoe. Hibiscus elatus	*Malvaceae*	,,
Nedun. *S.* Pericopsis Mooniana	*Leguminosae*	Ceylon.
Oak, African. Lophira alata	*Ochnaceae*	W. Trop. Africa.
—, Ceylon. Schleichera trijuga	*Sapindaceae*	Ceylon, India, Java.
—, She. Casuarina equisitifolia	*Casuarineae*	Queensland and New South Wales.
—, Silky. Grevillea robusta	*Proteaceae*	
Padouk. Pterocarpus indicus	*Leguminosae*	Burma.
Palu, *S.* Mimusops hexandra	*Sapotaceae*	Ceylon and India.
Pehimbiya, *S.* Filicium decipiens	*Burseraceae*	Ceylon and W. India.
Purple-heart. Copaifera pubiflora	*Leguminosae*	British Guiana.
Rosewood. Macherium firmum	,,	Brazil.
—, Indian Dalbergia latifolia	,,	Bengal and S. India.
Sal. Shorea robusta	*Dipterocarpeae*	India, Burma, etc.
Sandalwood. Santalum album	*Santalaceae*	Central India.
†Satinwood. Chloroxylon Swietenia	*Meliaceae*	S. India and Ceylon.
Suriya or Tulip Tree. Thespesia populnea	*Malvaceae*	Ceylon, Trop. Asia.
Tamarind-wood. Tamarindus indica	*Leguminosae*	India.
Teak. Tectona grandis	*Verbenaceae*	Burma.
—, African. Oldfieldia africana	*Euphorbiaceae*	Sierra Leone
Toona Tree. See Indian Mahogany	—	—
Trincomalie-wood; Halmilla, *S.* Berrya Ammonilla	*Liliaceae*	Ceylon, S. India, Burma.
Tulip Tree. See Suriya	—	—
Tulip-wood, Australian. Harpullia pendula	*Sapindaceae*	Queensland.
Wa, *S.* Cassia siamea.	*Leguminosae*	Ceylon, India, Malaya.
We-warani, *S.* Alseodaphne semecarpifolia	*Lauraceae*	Ceylon, dry region.

* Fetches up to £40 per ton in Colombo. † Worth about R25 (£1'13'4) per square foot in Colombo.

[S.=Sinhalese].

LAC CULTURE

Lac or Shellac is a resinous substance of an orange-reddish colour, produced by species of scale insects (chiefly *Tachardia lacca*) which live on the tender branches of certain trees, sucking the juice of the bark and forming a hard secretion known as lac. These incrustations, termed "stick lac," are removed from the trees by cutting the twigs or branches upon which they are formed, the resin being afterwards scraped off, washed and graded for export. The product is then known as "seed" or "grain" lac, which, after being melted in boiling water and poured on a cold surface, forms semi-transparent brittle flakes of a deep orange-colour, called shellac. The Indian word lac signifies 100,000, and refers to the large number of insects that emerge from the brood. Shellac burns with a luminous flame, and dissolves in alcohol or in a solution of borax. It is largely used in the manufacture of varnishes, French polish, lacquer, sealing wax, paints, lithographic inks, gramophone records, and in numerous other ways. The residual water in which lac is washed contains a dye of commercial importance. This was at one time highly valued, but since the discovery of synthetic dyes its value has much depreciated.

There is a constant and large demand for lac, and the value of the quantity produced annually in India is estimated at about five crores of rupees (=about £667,000). Lac has hitherto been practically entirely a forest product, being collected by the peasants from uncultivated trees in the forest or jungles. Its production under a definite system of cultivation has, however, been recently advocated, it being claimed that it can thus be produced more cheaply and in larger quantities than at present. It is asserted that in a suitable climate the cultivation of lac as a bye-product may be made remunerative, the inoculating of trees—either cultivated for other products or grown on pasture or waste lands as shade or shelter trees—with the brood lac being easily effected and requiring but little attention. As a secondary crop for the peasants, it would seem to offer prospects of a profitable industry. The work in connection with the crop is light and takes up comparatively little time, so that it need interfere but little with the grower's ordinary occupation. The necessary tools are few and inexpensive, and very little training is required.

CLIMATE.—A moderate warm climate is considered the most suitable for lac culture, hot winds and a temperature above 100.° Fah. being injurious to it. Three distinct seasons occur in

India where lac is obtained or cultivated, these being cold, hot, and rainy seasons. At Pusa, says Mr. N. WICKRAMARATNE, where lac has been grown successfully for the last few years for experimental purposes, the seasons are as follows:—"A cold season which begins in October and lasts till the middle of March, a hot season of three months lasting from then until June, and a rainy season from July till the end of September. The average annual rainfall is 45 in., and the temperature rarely rises above 100° Fah. Two crops are taken in the year, one called "Kartiki" in the beginning of October (from inoculation done in June-July) and the other called "Baisaki in June-July (from inoculation done in October), these corresponding to the "Yala" and "Maha" seasons in Ceylon."

LAC PRODUCTION IN CEYLON.—Lac is found on various indigenous and a few introduced trees in Ceylon, and is collected and employed by the native lac workers in the ornamentation of ceremonial staves, native furniture, toys, etc., but the industry is a small one, and the product is not exported to any extent. MR. GREEN, late Government Entomologist, stated that the species of insects producing lac here are *Tachardia Albizziæ* and *T. conchiferata*, which occur on *Albizzia stipulata*, *Croton aromaticus*, *Filicium decipiens* and others. These do not produce so plentiful an incrustation of lac as the Indian form (*T. lacca*). Efforts have therefore been made to introduce and establish the latter, but so far without success. (1913).

TREES SUITABLE FOR LAC CULTURE.—Certain trees appear to offer more attraction to the lac insects than others, and the quality of the article appears to be affected by the species of tree upon which it is produced. In India the best lac is said to be obtained from *Schleichera trijuga* (known here as the "Ceylon Oak"), which is also a heavy yielder. Spreading or bushy trees which produce young branches at frequent intervals, or will stand being pruned or coppiced so as to encourage fresh tender growth, are the most adapted. The following are some of the principal lac trees in India and Ceylon:—

NAME.		Natural Order.
Albizzia stipulata.	"Kabal-mara", *S.*	Leguminosae
Anona palustris.	Alligator-apple.	Anonaceae
Butea frondosa.	"Pulas."	Leguminosae
Croton aromaticum.	"Wel-keppitiya," *S.*	Euphorbiaceae

[S=Sinhalese]

NAME.		Natural Order.
C.--lacciferus.	"Keppetiya," S.	Euphorbiaceae
Ficus religiosa.	Peepul or Bo-tree.	Urticaceae
Filicium decipiens.	"Pehimbiya," S.	Burseraceae
Harpullia cupanioides.	"Na-imbul," S.	Sapindaceae
Mangifera indica.	Mango.	Anacardiaceae
Pithecolobium Saman.	Inga-saman, Guango, or Rain-tree.	Leguminosae
Rhus vernicifera.	Japan lac.	Anacardiaceae Exudation produced by tapping the stem.
Schleichera trijuga.	Kon, S. Kusumb, *Ind.*	Sapindaceae
Zizyphus jujuba.	"Mason," S. "Ber," *Ind.*	Rhamnaceae

RETURNS.—It is estimated that under average conditions a yield of 4 to 6 lb. of stick lac per tree may be obtained. 88 lb. "stick" will afford ½ cwt. "seed lack." Seed or granular lac, produced on *Pithecolobium Saman* in India, has been recently valued by PROFESSOR DUNSTAN, Director of the Imperial Institute, at 55*s.* to 60*s.* per cwt. "Ordinary" shellac is usually quoted in London at 45*s.* to 50*s.* per cwt., and "good soluble" or "fair spot" at 60*s.* to 70*s.*

SERICULTURE

As is well known, the production of silk is due to the "worms" (caterpillars) of certain moths, which in some countries, as in China, parts of Southern Europe and Northern Asia, are cultivated, or rather bred, in enormous numbers in order to produce their cocoons, which furnish the silk of commerce. The worms are reared in light airy sheds, on tiers of trays, and fed by the leaves of certain plants which they eat voraciously. There are several species of silk-producing worms, the principal being the Mulberry silk-worm (*Bombyx Mori*) which feeds chiefly on the Mulberry leaves; the Eri worm (*Attacus ricini*), which feeds on the Castor-oil plant; and the Tussar worm (*Antheraea Pernyi*), which feeds chiefly on the Oak. The worm of the Atlas moth (*Attacus atlas*), which is common in Ceylon, also produces a good second-rate silk and is omnivorous as regards its food. The Mulberry kind is the most important and is the one grown so extensively in Europe; the Eri is much in favour in India, while the Tussar is produced chiefly in China. The mulberry silk-worm yields the best quality silk, and its mode of existence, like that of other silk-worms, is briefly as follows. The moth lays its eggs, often to the number of 500 or more, on a leaf or twig, to which they adhere by means

of a gummy substance. These are placed on trays in light airy sheds to hatch out. The caterpillars resulting, at first blackish or obscure, become a paler tint in about 10 days, finally becoming yellow when about 4 weeks old and ready to spin.

SPINNING. Before commencing to spin the caterpillars fast for 36 hours, void all their excrements, become soft and flaccid and seek a suitable spot for the construction of their cocoons. Two or three days are occupied in the operation of spinning the latter, and the thread of a single cocoon is sometimes 900 yards in length. The process of spinning is effected by passing the thread through two small holes (spinerets) in the head of the worm, which by a combined movement of the mouth and front legs unites the filament into one, binding it closely together by a gummy liquid. The cocoon finished, the worm then undergoes metamorphoses, that is, it changes into the chrysalis or pupa state. In about two or three weeks the moth, under natural conditions, emerges by forcing its way through the cocoon. The males appear first, then the females; the former being comparatively active in their movements; they proceed at once to pair, and both live but a few days, the females meantime laying their eggs and thus completing the life cycle. Under the artificial conditions of sericulture, however, the moth is not permitted to emerge from the cocoon, as in doing so the latter is seriously damaged, both by the act of piercing and by the dirt and stain left behind. Therefore in order to obviate this the pupæ are destroyed by heating the cocoons in an oven or by crushing.

The indispensable conditions for successful sericulture are cheap labour and a plentiful supply of suitable food for the worms. In Italy and other silk-producing countries it is essentially a cottage industry, carried on mainly by women. Efforts have been made from time to time to establish sericulture as an industry in Ceylon, it being considered an occupation peculiarly adapted to the peasants. The question of culture has in itself proved successful, and as a result of experiments excellent commercial samples of both the mulberry and eri cocoons have been produced. But hitherto the people have not shown much enthusiasm in the new venture. The chief obstacle in the way is probably the fact that the destruction of the chrysalis in the cocoon, by whatever means, constitutes an offence against the Buddhist religion. To obviate this there are two alternatives: (1) to allow the mulberry moth to mature and emerge from the cocoon, and dispose of

the latter as silk "waste," an inferior grade; (2) to cultivate the eri worm whose cocoon, though an inferior silk, with only a limited Indian market, is not of the reelable kind and therefore does not necessarily involve the destruction of the pupa or chrysalis. Though the product in either case could not compete with the properly treated mulberry cocoons of other countries, yet it is thought that this might be compensated for by obtaining a large outturn, which might be effected by selecting and rearing multivoltine strains; this latter factor is especially in favour of sericulture in a tropical country, the silk-worm in Europe being always univoltine, i.e., producing but one crop annually, the worms undergoing metamorphoses once a year only.

Both the mulberry and castor-oil plants flourish in Ceylon at various elevations, the latter having become naturalised and is often found in a wild state, especially in the neighbourhood of villages. The castor-oil plant is readily propagated by seed, and the mulberry by cuttings. Mr. C. Drieberg, Secretary to the Ceylon Agricultural Society, who has done much to foster the new industry, writes:—"The Ceylon Agricultural Society is endeavouring to establish the silk industry in Ceylon by every available means—distributing silk-worm eggs, leaflets of instructions, seeds of the castor-oil plant and cuttings of mulberry. At Peradeniya, a demonstration silk farm has been started by the Society which has recently been given over to the Salvation Army to work, in view of the facilities which that body possesses for reaching the people. Work on the farm is progressing satisfactorily, and excellent samples of silk of the Eri, "Mysore," and a hybrid "Mysore-Bengal" worm have been reeled. At the farm, instruction in silk culture is given to teachers and others, and it is hoped ultimately to push the industry through Government Vernacular Schools. It is hoped that ultimately silk-culture will be taken up as a home industry in the villages.

According to Captain Jorgenson, Manager of the Salvation Army Silk Farm at Peradeniya, if the eri cocoon is obtained white and free from stain and dirt, it will command a satisfactory price in the European markets. "In order," he writes, "to produce the desired article, our plan is to cut open the cocoon on the fifth day before the chrysalis removes its outer skin, which often causes a stain. Each cocoon is cut open with a pair of scissors, and the chrysalis thrown out to the fowls. It is a simple operation, and can be done by children. This plan, however, may

offend the prejudice of some. One of the great advantages of the Eri cocoon is that one can allow the moth to escape without the necessity for destroying the chrysalis ; where the above plan causes offence, the chrysalis may be allowed to escape. The stained cocoon will, however, fetch a lower price. What merchants in Europe object to is not so much the stain as the dirt which always attaches to such cocoons. In some markets the merchants usually deduct 5 per cent. for dirt in estimating the value of the cocoons. One reason why the white cocoons are preferred by the manufacturers is that they are more easily dyed. The brown cocoons, however, generally realize a good price. In order to secure the whiteness of the cocoons, the best plan is to place the worms in layers of crumpled newspapers in a basket for spinning their cocoons. We have found this very effective. We bale the cocoons according to their quality. Those that are white and quite clean go in one class, those that are partially clean go in another, while those of bad colour go in a third."

CHAPTER XXV

1. PERFUME-YIELDING PLANTS
2. HONEY PLANTS
3. ORNAMENTAL SEEDS
4. CURIOUS FRUITS
5. POISONOUS PLANTS
6. INSECTIVOROUS AND FLY-CATCHING PLANTS
7. MYRMECOPHILOUS PLANTS

PERFUME-YIELDING PLANTS:—

The extraction of perfume from flowers affords an important industry in some countries, notably in France, where roses, orange blossoms, jasmine, violets, tuberoses, etc., are used by the ton for the purpose. The two principal methods of scent extraction adopted by perfume manufacturers are *distillation* and *maceration* or enfleurage, and flowers which are adapted for treatment by either of these methods may be unsuited to the other. The following notes apply to such perfume-yielding plants as may be suitable for cultivation in Ceylon or in similar tropical countries :—

Roses.—Cultivated for their scent, about 5,000 rose plants may be planted per acre. After the second year an acre may produce about 6 cwt. of rose petals in the year, these yielding by distillation about 70 ounces of attar of roses, valued at £20 to £30 per lb.

Bergamot (*Citrus bergamia.* Rutaceæ).—A kind of bitter orange yielding a valuable perfume from the rind, known as "bergamot." 1,000 fruits will yield about 30 oz. of oil, which when pure is worth from £1 10*s.* to £2 per lb. The tree requires much the same treatment as the sweet orange, and in plantations is generally planted about 12 feet apart each way. Another variety of bitter orange called the "Bigardeer" is valued for its flowers, a kilogramme of which yields, on an average, 2 grammes of essence, which is worth, according to quality, from £10 to £18 per lb.

Cedrat (*Citrus medica.* Rutaceæ).—A highly scented oil obtained from the rind of the citron, worth about 18*s.* or more

per lb. It is not much used for scenting soaps, being too costly for that purpose, but enters largely into the composition of handkerchief perfumes.

Frangipanni. The odour of the white, cream, or crimson waxy flowers of the Temple Tree (*Plumeria spp*) closely resembles the perfume frangipanni, and it is considered that it would pay to extract the scent by distillation, or by the usual method of maceration in liquid fat, etc. The Temple-tree is common at low elevations in Ceylon, especially near Buddhist temples, and is easily propagated by cuttings.

Geranium (*Pelargonium capitatum.* Geraniaceæ)—This plant, which may easily be grown up-country, is cultivated extensively in Northern Africa and Southern Europe for the sake of the delightful rose-smelling oil obtained from the strongly scented leaves and stems by distillation. This oil is worth about 4*s.* per oz. In plantations 3,000 to 4,000 plants are allowed to the acre; one planting lasts four years, and three cuttings of leaves and shoots are obtained from the plants in one season.

Jasmine. (*Jasminum spp.* Oleaceæ).—The perfume or otto obtained from Jasmine flowers by absorption on clarified fat is said to be one of the most prized by perfumers, on account of its sweet and delicate odour and the impossibility of imitating it, and is said to be worth about £9 per fluid ounce. In France, about 8,000 Jasmine plants go to the acre; this number yield about 5 cwt of blossoms, which in turn will perfume 1½ cwt. of fat valued at about 12*s.* per lb.

Lemon-grass; Verbena-oil (*Andropogon citratus.* Graminæ).—The oil obtained by distillation from the leaves of Lemon-grass is generally employed in the perfuming of scented soaps, also in adulterating "otto of roses" and true "verbena oil." It is sold in London at about 6*d.* per ounce.

Patchouili. (*Pogostemon Patchouli*, Labiateæ).—A small herbaceous plant, about 2 feet high, native of Sylhet, Penang, and Malacca. By distillation of the leaves and young tops a volatile oil is obtained, and from this "Essence-of-Patchouli" is prepared. Patchouli perfume is highly popular in India as well as in Europe, and is much used in the preparation of other perfumes. With care, the plant will grow at medium elevations in Ceylon, though probably not sufficiently well to be profitable. In England, Patchouli leaves are said to be sold at 9*d.* to 1*s.* 3*d.* per lb., and the pure oil at from 2*s.* 6*d.* to 3*s.* 9*d.* per ounce.

Priprioca. (*Mespilodaphene* (*Ocoica*) *pretiosa*).—A Brazilian tree, found in the forests of Amazonia. "The leaves when bruised give off an agreeable perfume, recalling clove, cinnamon and bergamot at the same time." Considered to be of possible value in perfumery and soap-making.

Tonka, Tonkin, or Tonga Bean, Known in Venezuela as "Serrapia" (*Dipteryx odorata.* Leguminosæ).—A large tree, native of Tropical America, introduced to Peradeniya in 1881. The fruit is an oblong, fibrous pod, containing one almond-shaped black seed. The seeds are fragrant, possessing the odour of new-mown hay, and are used by perfumers for bouquets, as well as in the preparation of sachet powders. They are also employed in scenting soap, snuff, etc., and a "tincture of tonka" is sometimes used by pastry cooks and confectioners as a substitute for vanilla. The seeds when dried are subjected to a crystallisation process, being soaked in rum for 24 hours and then slowly dried, when they become covered with white crystals. Tonka beans fluctuate greatly in price, according to supply and demand. According to the *Chemist and Druggist* the price has varied from 20*s.* to 7*s.* per lb. in less than 12 months. At the time of writing, it is quoted at 7*s.* per lb.

Tuberose (*Polianthes tuberosa.* Liliaceæ). A tuberous herbaceous plant, much cultivated in the South of France for the extraction of perfume from its powerfully scented flowers. The plant grows and flowers freely at medium and high elevations in Ceylon.

Ylang-ylang, or Ilang-ilang; "Wana-Sapu" *S.* (*Cananga odorata.* Anonaceæ).—A large, quick-growing tree, 60 to 80 feet high, native of the Philippines, Java, etc. The large greenish-yellow flowers are strongly scented, and yield by distillation the popular scent "ylang-ylang" or "ilang-ilang." A full-grown tree may be considered to yield 100 lb. to 120 lb. of fresh flowers during its flowering season. From 150 to 200 lb. of flowers produce about 1 lb. of the essence, the collection and distillation of which is said to form an important minor industry in the Philippines. Here it is estimated that an acre planted with 150 trees may give 3,250 lb. of flowers, yielding about 16 lb. of essence. The main supply, however, is from uncultivated trees. The Natives collect and sell the flowers from these for 2*d.* per lb. The annual export of ylang-ilang oil from the Philippines is now valued at about £20,000.

In addition to the foregoing, the following are also noted for the fragrance of their flowers or leaves :

TREES :

Caesalpinia coriaria. "Divi-divi."
Cassia nodosa
Citrus Decumana. Pumelo.
Fagraea fragrans. "Tembusu" or "Tembusi" (Malay.)
Mesua ferrea. Ceylon "Iron-wood;" "Na-gaha" *S.*
Michelia Champaca. Champac; "Sapu" *S.*
Murraya exotica. "Etteriya" *S.*
Myristica. Horsfieldii
Nyctanthes Arbor-tristis. "Sepalika," *S.* or "Night-flowering Jasmine."
Ptercorpus marsupium.
Haematoxylon campechianum. Logwood.
Tabernæmontana coronaria. Wax-flower.
T.—dichotoma. "Divi-kaduru."

SHRUBS :

Brunfelsia bicolor
Gardenia florida
Hibiscus Abelmoschus. Musk Mallow. Seeds yield musk-like odour, used in perfumery. Worth 1*s.* to 1*s.* 6*d.* per lb.
Jasminum Sambac
Lawsonia alba. Mignonette Tree.
Lippia citriodora. "Lemon-scented Verbena."
Michelia fuscata. "Mathanakama." *T.*
Ocimum basilicum. Sweet Basil.
O.—sanctum. "Maduru-tala" *S.*
Stemmadenia bella.
Talauma mutabilis.
Wrightia zeylanica. "Sudu-idda" *S.*

CLIMBERS :

Artobotrys zeylanicus. "Petika-wel," *S.*
Asparagus falcatus. "Hathawariya," *S.*
A.—racemosus.
Camoensia maxima.
Jasminum flexile.
Lonicera Hilderbrandtii. Giant Honey-suckle.
Odontadenia speciosa
Pergularia odoratissima.
Stephanotis floribunda.

HONEY PLANTS

Bees have their likes and dislikes in regard to the flowers they visit for extracting honey from, and the quality of the honey produced by them largely depends on the kind of flowers which they frequent. Persons who have taken up bee-keeping in Ceylon or other tropical countries must have sometimes experienced a difficulty in providing a sufficient supply of suitable flowering plants or trees for their bees ; to these the following list of trees or shrubs especially suited for the purpose may be a guidance. Mr. C. Drieberg, who has given the subject much attention, states that Ceylon bees seem to travel great distances in search of honey-flowers, apparently preferring trees to shrubs and smaller plants. In the West Indies, "Logwood" honey is considered to be about the best, though the flowers of the Pigeon Pea (" Rata-tora ") and Lime-tree (Citrus) are also considered to yield honey of excellent quality.

SELECTED HONEY-FLOWERS OR BEE PLANTS

[T=Tree: Cl=Climber: S=Shrub: H. P.=Herbaceous Perennial: A=Annual].

Name.	See above.	Name.	See above.
Acacia dealbata. Silver-wattle	T	Kleinhovia hospita.	T
Antigonon Leptopus, & other species.	Cl	Lantana. Several species	S
Bassia longifolia. "Mi." *S.*	T	Logwood (Haematoxylon).	T
Caesalpinia coriaria. "Divi-divi"	T	Mangifera indica. Mango	T
Cajanus indicus. Pigeon Pea; "Rata-tora" *S.*	S	Michelia Champaca. Sapu	T
Canarium commune. Java almond.	T	Mignonette (Reseda odorata).	A
Caryota urens. Kitul or Toddy Palm.	T	Murraya exotica	S or T
Cassia grandis. Horse cassia.	T	Nasturtium (Tropaeolum.)	A. Cl.
Cassia nodosa.	T	Pometia exima.	T
Citrus Limetta. "Lime," also various other species of Citrus.	S or T	Porana volubilis	Cl
Cocos nucifera. Coconut Palm.	T	Portulaca oleraceae	A
Durio zibethinus. Durian Tree	T	Ptercorpus indicus.	T
Elaeocarpus serratus. Wild olive	T	Rhus glabra.	T
Glycosmis pentaphylla.	S	Sarcocephalus esculentus	Cl. S.
Guizotea olifera.	A	Schleichera trijuga	T
Grevillea robusta Silky Oak.	T	Strobilanthes, various species.	S
Humboldtia laurifolia.	S	Terminalia Belerica. "Bulu." *S.*	T
Ipomoea carnea	Cl	Turnera elegans.	H. P.

ORNAMENTAL SEEDS

In the tropics there is found a large number of curious or ornamental seeds suitable for making articles of ornament or utility, as beads, necklaces, rosaries, mats, buttons, etc. It is noteworthy that the majority of such seeds are furnished by the natural orders of Leguminosæ and Palmæ, although many are produced also by the orders Euphorbiaceæ, Apocynaceæ and Scitamineæ. Boring the seeds for necklaces, etc., may be done by fixing the seed firmly and using a fine drill, or by passing a red-hot needle through it. No attempt should be made to soften the seed by soaking in water, which will result in loss of brilliancy in colour, if not in the swelling and splitting of the seed. The following are some of the more striking of such seeds:—

Abrus precatorius. "Crab's eyes." Seeds scarlet with a black spot; used for rosaries, necklaces, goldsmiths' weights, etc.

Adenanthera pavonina. "Bead Tree." Seeds bright scarlet, used for necklaces, etc., also for jewellers' and apothecaries' weights.

A—bicolor. Seeds smaller than the latter, half-black and half-red, very ornamental.

Caesalpinia Bonduc. Nicker seeds. "Kumburu-wel," *S.* Large ash-grey, polished and very hard, round or oval.

Canna indica. "Indian Shot," Seeds black, round or oval, of the size of small peas, very hard.

Cocculus macrocarpus. "Atta-tithavel." By depriving the kidney-shaped fruit of its outer covering (epicarp) the remarkable annular endocarp is exposed.

Coix Lachryma—Jobi. "Job's Tears." Very hard, grey, polished seeds; used for rosaries, bead-work, etc.

Corypha umbraculifera. Talipot Palm. Seeds round, of the size of marbles, hard and grey, used for buttons and ornaments.

Elaeocarpus Ganitrus.—The round warty brown fruits, when dry, used as heads for hat pins ; when fresh it is covered by a bright blue skin.

Entada scandens. Elephant Creeper." Remarkable large flat brown seeds.

Erythrina corallodendron. Coral-bean Tree. Seeds scarlet, with a black spot; strung as beads in chaplets.

Hevea brasiliensis. Para rubber Tree. The large roundish mottled and blotched seeds make excellent beads for hat-pins.

Manihot Glaziovii. Ceara rubber Tree. Oblong flattened hard seed, mottled grey and brown.

Metroxylon Sagu. Sago Palm. Round or cone-like reddish fruits, with a rind formed of hard polished small scales.

Mucuna atropurpurea. Punnakalichi, *T.* Large roundish and compressed seed, grey mottled with brownish black.

Mucuna pruriens. "Horse-eye Bean;" Cowhage or Cowitch. The large oval seed resembles the eye of a horse. Pods of this and above species covered with brown irritant bristles.

Oroxylon indicum. "Totilla" *S.* Seeds with curious membranous, flat circular wing.

Ormosia dasycarpa. "Necklace Tree." Seeds large, oval or roundish, bright scarlet, blotched with black or brown. Very popular for making buttons, necklaces and ornaments.

O.—coccinea. Seeds similar to the preceding species, but smaller.

Poincania regia. Flamboyante. Seeds hard, oblong, and mottled grey.

Phyllanthus cyanosperma. Seeds rather small, wedge-shaped, bright shiny deep-blue.

Phytelephas macrocarpa. Ivory-nut Palm. The large hard white ivory-like seeds are used as a substitute for ivory, being employed in the manufacture of buttons, etc. Exported from S. America. (See under *Vegetable Ivory.*)

Raphia ruffia. Raffia Palm. Round or conical large, brown polished scaly fruits, suitable as heads for hat pins.

Rhyncosperma cyanosperma. Violet-black seeds, used as ornaments by hill people in India.

Sapindus saponaria. "Soap Berry." Round black seeds, often strung as beads or rosaries, sometimes used as buttons.

Thevetia neriifolia. "Lucky-beans," or "Lucky-seeds." In the West Indies the hard oblong seeds are mounted and used as pendants and charms.

REMARKABLE OR CURIOUS FRUITS

Barringtonia speciosa. "Mudilla." (*Myrtaceae*). A large, curious 4-angled cube-like fruit. See *Flowering Trees.*

Cassia Fistula. Pudding Pipe, "Eh-ela." (*Leguminosae*). Long cylindrical brown pods, up to 3 feet in length. See *Flowering Trees.*

Castanospermum australe. Moreton Bay Chestnut. (*Leguminosae*). Stout brown pods, 5 to 7 inches long, with hard shells and large brown oval seeds.

Citrus Decumana. Pumelo. (*Rutaceae*). Large globular succulent fruits, yellowish or bright orange-yellow. See *Fruit Trees.*

Couroupita guianensis. Cannon Ball. (*Myrtaceae*). Large round brown fruits of the size of a man's head. See *Flowering Trees.*

Crescentia Cujete. Tree Calabash. (*Bignoniaceae*). Very quaint large smooth-shelled fruit, oval in shape. The hard shell is polished and used for ornaments.

C.—plectrantha. Tree Calabash (*Bignoniaceae*) Fruit as above, but round-shaped.

Cucurbita maxima. Pumpkin; Wataka, *S.* (*Curcurbitaceae*). A climbing or creeping gourd, bearing immense round smooth fruits, which are generally flattened at both ends; the seasoned and polished shells last for many years.

Dillenia indica. "Honda-para" *S.* (*Dilleniaceae*). Large greenish succulent fruits. See *Fruit Trees.*

Lodoicea sechellarum. Double-Coconut; Coco-de-mer; "Mudu-pol," *S.* (*Palmae*). Immense hard-shelled nuts, usually 2-(sometimes 3-) lobed. Peculiar to Seychelles. Introduced at Peradeniya in 1850.

Entada scandens. Elephant Creeper; "Pus-well" *S.* (*Leguminosae*). An immense jungle climber, bearing enormous flat pods, 4 to 5 ft. long by 3-4. in. broad. Forests of moist low-country. See. p. 576.

Hura crepitans. Sandbox Fruit. (*Euphorbiaceae*). Curious round hard fruit, flattened at both ends and divided into numerous rounded sections each containing one seed; dehisces explosively with a loud report.

Hydnocarpus octandra. (*Bixaceae*). Round, jet black, velvety, pendulous fruits of the size of oranges.

Jumping Beans. The maggot of a moth (*Carpocapsa saltitans*), which is hatched inside the small half-round capsule of certain Euphorbiaceous trees of Mexico, whence the "bean" is exported as a curiosity. Warmth renders the maggot active, when the beans begin to roll or jump about.

Kigelia pinnata. Sausage Fruit. (*Bignoniaceae*). Stout pod-like fruits, 14 inches or more in length by 3 in. in diameter, suspended by long thin cords 4 to 6 ft. in length; produced by a spreading medium-sized tree.

Lagenaria vulgaris. Bottle Gourd. (*Cucurbitaceae*). Variously shaped large gourds, often bottle-or club-shaped, 1 to 2 ft. or more in length.

Lecythis Ollaria. Monkey Pot. (*Lecythidaceae*). A large hard woody brown fruit, furnished with a close-fitting lid at the top.

Martynia diandra. Snake's Head; Tiger's-claw; Naka-tali, *T.* (*Pedaliaceae*). Hard woody oblong fruits with 2 strong curved spines, native of Mexico, naturalised in Ceylon.

Ochroma lagopus. Down Tree. (*Malvaceae*). Curious brown, erect fruit, which when dehisced resembles a brush of soft greyish down.

Ochrosia acuminata. (*Apocynaceae*). Bright red, oval fleshy fruits, 1½ to 2 in. long. Ornamental but poisonous.

Oroxylum indicum. "Totilla." (*Bignoniaceae*). Immense, slightly curved pods, resembling cricket bats at a distance.

Pandanus Leram. Nicobar Breadfruit. (*Pandanaceae*). Huge fleshy fruits borne at base of leaves; orange yellow when ripe.

Pangium edule. Pangi. (Mal.) (*Bixaceae*). A large Malayan tree with broad leaves. The large rusty-brown woody fruits are of the size of small coconuts, said to be poisonous until boiled and macerated in water, when they become edible.

Parmentiera cereifera. (*Bignoniaceae*). Remarkable candle-like pale yellow fruits, borne on stem and branches. See *Ornamental Foliage Trees*.

Sterculia Balanghas. "Nawa" S. (*Sterculiaceae*). Large yellow shell-like fruit; when dehisced it exposes black shiny seeds which hang from the margins like teeth.

Tabernaemontana dichotoma. Forbidden Fruit; Eve's Apple; "Divi-kaduru," S. (*Apocynaceae*). A small tree of Ceylon and S. India, with pale grey bark, common at low elevations. The curious pendulous fruit is half-round, with a clean-cut depression along one side, which has suggested the popular names, being supposed to resemble a partly eaten fruit. Some even imagine they see in it Eve's teeth marks!

POISONOUS PLANTS

Certain families of plants are characterized generally by distinct poisonous characters, while others, as the Cruciferæ, are remarkably free from any poisonous traces. To the former belong Aroideæ, Euphorbiaceæ, Apocynaceæ, Asclepiadeæ, Urticaceæ, Solanaceæ, Umbelliferæ, Loganiaceæ, and others. Some of these, however, as Solanaceæ and Umbelliferæ, also furnish wholesome food products. Any plant which possesses a milky juice should be treated with caution until more is known about it. In former times, and even till this day in certain uncivilised countries, persons suspected of witchcraft or crime were made to swallow portions of certain poisonous plants, or confess the alleged offence; if the persons died from the effects they were considered to be guilty, while if they vomited the poison they were held to be innocent. The following are well-known ordeal poisons.

HISTORICAL OR ORDEAL POISONS

Hippomane mancinella; Manchineal Tree. (*Euphorbiaceæ*). A celebrated poison tree of tropical S. America; it is also indigenous to some W. Indian islands.

Erythrophlœum guineense; "Sassy Bark" (*Leguminosæ*). A well-known poisonous tree of Sierra Leone.

Antiaris toxicaria; Upas Tree. (*Urticaceae*) The celebrated poisonous tree of Java, at one time supposed to give off poisonous fumes fatal to animal life. The milky latex contains a virulent poison.

Physostigma venenosum. (*Leguminosae*). A large twining climber whose large oval dark-brown seeds are the famous ordeal-beans of Old Calabar.

Cerbera Tanghin (*Apocynaceae*). A small tree with a milky juice, whose fruits are the ordeal poison of Madagascar.

GENERAL POISONOUS PLANTS

Acokanthera spectabilis. Arrow-poison. (*Apocynaceae*). Root and wood used by Natives in Africa for poisoning arrows.

Alyxia zeylanica. "Walkaduru" or "Wasakaduru," *S.* (*Apocynaceae*). A shrub found in semi-dry regions; the milky juice is poisonous.

Cerbera Odalam. "Gonkaduru," *S.* (*Apocynaceae*). A small tree with acrid milky juice and white scented flowers; common in low-country, chiefly near the sea. The seeds are an irritant poison.

Datura fastuosa. "Attana" *S.* (*Solanaceae*). Small shrub, with large leaves and large white or purple trumpet-shaped flowers; fruit round, with numerous prickles, poisonous.

Datura suaveolens. Trumpet flower; "Rata-attana." *S.* (*Solanaceae*). A shrub with large white or purple flowers, native of Mexico. The round green prickly fruits are a well-known poison.

Dieffenbachia, many spp. & varieties (*Aroideae*). Herbaceous branchless succulent plants, bearing a crown of large variegated leaves, commonly cultivated for ornament. The juice is highly acrid and poisonous; the slightest contact of a portion of it with the tongue will cause the latter to swell, making speech almost impossible for some time.

Euphorbia antiquorum. "Daluk," *S.* (*Euphorbiaceae*). A spreading leafless tree, 15-30 ft. high, found in rocky places in the low-country; branches 3-winged, very spiny. The acrid milky juice is poisonous.

Euphorbia tortilis. "Sinuk" *S.* (*Euphorbiaceae*). A small leafless tree, found in similar places to Daluk; milky juice acrid and poisonous.

Excaecaria Agallocha. "Tala-kiriya," *S.* Blinding Tree. (*Euphorbiaceae*). Small tree with extremely acrid milky juice, common on the coast of Ceylon and other Eastern countries.

Girardinia heterophylla. Elephant or Nilgiri Nettle; "Gas-kahambiliya," *S.* (*Urticaceae*). A tall herb, covered with stinging poisonous hairs; found in forests of montane zone.

Gloriosa superba. "Niyangala," *S.* "Ventonti," *S.* (*Liliaceae*). A herbaceous climber with whorled leaves whose tips end in a spiral tendril; the large fleshy tubers are poisonous.

Hydnocarpus venenata. "Makulu," *S.* (*Bixaceae*). A medium-sized tree with smooth bark, common in low-country; fruits poisonous, used for poisoning fish.

Isotoma longiflora. (*Campanulaceae*). An annual weed with white flowers, introduced from Jamaica; has an acrid poisonous milky juice, which has been considered to be the cause of deaths amongst ponies on the Delft Island, North of Ceylon.

Laportea crenulata. Fever-or Devil-nettle; "Maussa," *S.* (*Urticaceae*). A large shrub with large oval leaves; whole plant clothed with minute stinging hairs, which sting severely, the distressing effects often remaining for many days.

Lobelia nicotianaefolia. "Wild Tobacco;" Rasni, *S.* (*Campanulaceae*). A large herbaceous perennial, 4 to 10 ft. high, with large oblong leaves, found in open ground at 4,000 to 7,000 ft. The leaves and seeds are acrid and poisonous.

Mirabilis Jalapa. Jalap Plant; Marvel-of-Peru; Four o'clock Flower; Handrikka. *S.* (*Nyctagineae*). An annual, 2 ft. high, with white or pink flowers. Roots and seeds poisonous.

Modecca palmata. "Hondala" or "Potu-hondala," *S.* (*Passifloraceae*). Small perennial climber with large shiny leaves, common in moist low country; the round scarlet fruit, of the size of an orange, is poisonous and has been known to cause death.

Nerium oleander. Oleander; "Arali" or "Araliya," *S.* & *T.* (*Apocynaceae*) Shrub or small tree, with milky juice and large showy pink or white flowers. The roots are poisonous.

Ochrosia borbonica. "Mudu-kaduru," *S.* (*Apocynaceae*). Small tree with greenish white flowers, common near the sea-coast; the bright red fruit is considered poisonous.

Plumbago zeylanica. "Ela-nitul," *S.* (*Plumbagineae*). A perennial herb, with long succulent roots, which are acrid and pungent, being sometimes used for illegal purposes.

Sapium indicum. "Kiri-makulu," *S.* (*Euphorbiaceae*). Small tree with smooth white bark and willow-like leaves; the acrid milky juice is very poisonous

Solanum verbacifolium. "Hekarilla," *S.* (*Solanaceae*). Large shrub. covered with a dense yellowish-grey tomentum; moist region up to 6,000 ft. Fruit poisonous.

Streblus asper. "Geta-netul," *S*; "Pirasu," *S.* (*Urticaceae*). A shrub or small. tree, with scabrous leaves, common in the low-country. The yellow fruit is edible, but the bark is an irritant poison.

Strychnos Nux-vomica. Nux-vomica; "Goda-kaduru," *S.* (*Loganiaceae*). A fairly large tree, common in the forests of the dry region; the seeds are the source of strychnine and are powerfully poisonous

Yucca gloriosa. Adam's Needle. (*Liliaceae*). A semi-woody branchless plant, 6 to 8 ft. high, with long, rigid, sharply pointed leaves; the roots are poisonous.

INSECTIVOROUS, FLY-CATCHING AND ALLIED PLANTS

Aldrovanda vesiculosa. Water fly-trap. (*Droseraceae*). A rootless swimming water-plant of S. Europe, remarkable for the inflated extremities of the sensitive leaves, which act as floats and for capturing small water animals, which the plant digests.

Aristolochia, many species. "Fly catching Plants." (*Aristolochiaceae*). A remarkable family of plants (mostly climbers), with variously shaped flowers, which in some species are very large; most have an offensive odour, which attracts flies. In most species the flowers are adapted to

entrap the latter which, once inside, are unable to escape owing to the bend in the middle of the flower tube and the numerous hairs which all point inward. The flies are usually essential to the pollination of the flowers, and once this is effected the hairs collapse and thus often enable the flies to escape unharmed.

Cephalotus follicularis. Pitcher Plant of Australia (*Cephalotaceae*). A remarkable marsh plant of W. Australia, bearing two kinds of leaves, one form being transformed into pitchers, which capture insects much in the same way as Nepenthes.

Darlingtonia, several species. Californian Pitcher-plant. (*Sarraceniaceae*). A remarkable genus of perennial herbs found inhabiting marshy places in California. The leaf-petioles, as in Sarracenia, are formed into long pitchers, with the divided lamina or blade at the top.

Dionœa muscipula. Venus's Fly-trap. (*Droseraceae*). A small remarkable marsh plant of the S. United States. The spathulate leaves are furnished with peculiar bristles along the margin; they are extremely irritable and when touched by an insect close immediately and imprison the intruders; these are killed and the plant absorbs the product of their decay. The leaves will close also if touched by any solid substance.

Dischidia Rafflesiana. Leaf Pitcher Plant (*Asclepideae*). A climbing plant with two kinds of leaves, indigenous to Malay and Tropical Australia; the leaves are formed into closed pockets 3 to 5 in. long, with a small aperture at one end, into which an adventitious root from the stem is usually developed.

Drosera, many species. Sundew. (*Droseraceae*). A genus of small swamp plants found in most countries. Three species are indigenous to the montane zone of Ceylon. Leaves thickly set with glandular hairs, which are slightly irritable, being tipped with a minute drop of viscid fluid. By means of the latter, insects are caught, when the surrounding hairs combine to imprison them.

Drosophyllum lusitanicum. Sundew. (*Droseraceae*). A striking plant with similar characters as the above, inhabiting the sandy hills of Portugal.

Nepenthes. Several species. Pitcher Plant. "Bandura-wel," S. (*Nepenthaceae*) A genus of semi-climbing plants inhabiting moist swampy places in the tropics, mostly in Borneo, Sumatra, etc. *N. distillatoria* is indigenous to Ceylon. A prolongation of the midrib is modified into curious pitcher-like structures, with a lid at the top. These pitchers are in some species or varieties as much as 8 to 10 in. long; they usually contain a quantity of water, in which often a number of dead or dying insects are found, the product of their decay being assimilated by the plant.

Pinguicula vulgaris. Butterwort. (*Lentibulariaceae*) A bog plant indigenous to the British Isles, furnished with radical leaves of a sensitive character, incurved at the margins; stimulated by the presence of proteid bodies, they close over, when the sessile glands secrete a ferment and digest their prey

Sarracenia, several species: Side-saddle Flower. (*Sarraceniaceae*). Marsh plants of North America, the leaf petioles of which are modified into remarkable erect, often brightly coloured, pitchers, surmounted by a lid

formed by the small lamina. These pitchers usually contain water, in which flies and other insects are drowned.

Utricularia, several species. Bladderwort. (*Lentibulariaceae*). Water or bog plants without roots, found in swamps of most countries. The leaves are furnished with small bladders, which have a trap-door entrance and capture small crustacean and other animals.

MYRMECOPHILOUS PLANTS

[i.e., plants with special cavities or other adaptations for attracting and protecting ants for mutual benefit.]

Acacia Hindsii. (*Leguminosae*). Indigenous to Trop. Central America. The hollow formidable spines are generally inhabited by ants.

Acacia sphærocephala. (*Leguminosae*). Bull's Horn Acacia. Similar to above.

Cecropia peltata. (*Urticaceae*). Trumpet Tree. Hollow stems often inhabited by ants, also used by Natives for musical instruments.

Coccoloba, several species. (*Polygonaceae*). S. America and the West Indies. Hollow stems usually occupied by ants.

Cuviera, several species. W. Trop. Africa. Hollow swellings on stems.

Duroia hirsuta. S. America. Hollow stems, with entrances into which colonies of ants gain admission.

Humboldtia laurifolia. (*Leguminosae*). A shrub indigenous to Ceylon and S. India, with hollow internodes generally inhabited by ants.

Hydnophytum montanum, and other spp. (*Rubiaceae*) Epiphytic plants, native of Malaya, etc. remarkable for their swollen woody base, which is hollow and provides a home for ants.

Muehlenbeckia platyclada. (*Polygonaceae*). A scrambling shrub or climber, with hollow internodes indigenous to the Solomon Islands.

Myrmecodia Beccari and other spp. (*Rubiaceae*). Epiphytic plants, indigenous to Malaya, with a hollow tuberous base.

Triplaris surinamensis. (*Polygonaceae*). A tree of Surinam, with large hollow stems which harbour ants.

SACRED TREES OF INDIA, CEYLON, ETC.

The worship of certain plants or trees, supposed to possess supernatural qualities, was at one time practised in many parts of the world, and the custom has still survived among certain races in tropical countries. This is more especially the case in India, where numerous trees or plants are held more or less sacred or in high esteem for temple offerings. The following are some of the principal species thus employed :

Ficus religiosa. Bo-tree ; Peepul ; Aswatha, S. (*Urticaceae*). The most sacred tree of India and Ceylon, being venerated by Hindus, Buddhists and other races. Devout Buddhists will not injure the smallest seedling or branch of this tree. The specimen at Anuradhapura, Ceylon, is probably the oldest historical tree in the world, having been brought from India in B. C. 288.

Butea frondosa. Palas or Parasu. (*Leguminosae*). A beautiful tree, especially sacred to Brahmin races in India.

Melia Azedarach. Neem or Nim Tree ; Persian Lilac ; Bead Tree. (*Meliaceae*).

Nyctanthes Arbor-tristis. Sèpala or Sèpalika ; "Night-flowering jasmine." (*Oleaceae*). A small tree of Central India; the flowers are much used in Hindu worship and as votive offerings.

Plumeria acutifolia. Temple Tree. (*Apocynaceae*). A small tree, commonly planted near Buddhist temples in Ceylon, the highly-scented flowers being greatly esteemed as temple offerings.

Ocimum sanctum. Sacred Basil ; Tulsi. (*Labiatae*). A herbaceous perennial, 2 to 3 ft. high. This is the most sacred plant in the Hindu religion, and is consequently found near every Hindu house throughout India.

Stereospermum xylocarpum. "Padri Tree" of India.

Sterculia colorata. Malaiparutti, *T.* (*Sterculiaceae*). A handsome flowering tree, indigenous to the dry region (Eastern Province) of Ceylon. The aboriginals (Veddas) sing odes to it.

Prosopis spicigera. Sami Tree. (Leguminosae). A small tree sacred to the Hindus generally all over India.

Kigelia pinnata. Sausage Tree. (*Bignoniaceae*). A large spreading tree with large curious gourd-like fruits, indigenous to tropical Africa, in parts of which it is held sacred by the Natives. See p. 577, etc.

Nandina domestica. "Sacred Bamboo" of China. (*Berberidaceae*). An erect shrub with unbranching stems, bearing tufts of small pinnate leaves at the top, producing large panicles of creamy flowers, followed by red berries ; native of S. China, and much esteemed in that country for use at temples.

Nelumbium speciosum. Egyptian Lotus ; Olu, S. (*Nymphaeaceae*). A handsome water-plant with large round leaves, and very large pink or white flowers borne on erect stalks 2 to 3 ft. above the water. It has been held sacred by the Egyptians from time immemorial, and is also venerated in parts of India, China, etc.

CHAPTER XXVI.

1. PASTURE, GRAZING, AND FODDER PLANTS
2. MEDICINAL PLANTS OF CEYLON
3. EDIBLE HERBS USED IN CEYLON

PASTURE, GRAZING, ETC.

[S.=SINHALESE; T.=TAMIL].

A striking feature of agriculture in the tropics is the scarcity of pasture, natural or artificial, for grazing stock. Here we find the natural herbage characteristic of cooler climes replaced by jungle or scrub; a large portion of the natural grasses grow coarse and wiry; what should be herbs are shrubs, and weeds soon over-run cleared areas unless frequently eradicated. A contributing factor to the scarcity of pasture is the fact that our cultivated crops are mainly perennial trees or shrubs, not annuals as in temperate countries, so that it is impracticable to adopt any system of crop rotation, which ordinarily includes forage and grazing crops. Added to these circumstances, there is often either insufficient or excessive rainfall, or soil which is of a hard impervious nature and lacking in humus, the latter being one of the most essential ingredients in good pasture land. It must, however, be admitted that the absence of conditions which naturally conduce to good pasturage can to some extent be overcome, and circumstances demand that the best efforts be made to that end. Cattle are especially indispensable to the peasants, either for dairy or draught purposes, yet it is surprising how little is attempted to provide for their proper sustenance. The average native owner of cattle (and few who are not) seldom makes any attempt to provide pasture for them, and they are constantly allowed to roam and pick up what they can. A few head of cattle, properly nourished, should be regarded as a useful asset to every estate, whether in the low-country or at the higher elevations. In addition to their dairy produce, cattle furnish excellent natural manure. Some planters maintain that, for most crops, this is the best of all manures, and in the days of coffee cultivation in Ceylon

many kept a herd of cattle on the estate mainly for the sake of manure, as is still done on many coffee estates in South India. Good pasture land, too, may often bring in an appreciable return in grazing fees. Further, the average butcher's meat in the tropics is capable of much improvement by more attention being given to fattening cattle—a matter which at present receives but little consideration.

Formation of Pastures.—Low-lying flats or ravines, where the soil is of a moist sandy or alluvial nature, usually constitutes the best land for pasture purposes or for growing fodder grasses. The soil should be well-tilled by trenching or ploughing to a depth of 15 in. or more, removing the roughest stones, roots or other obstacles, and leaving a tolerably smooth surface. The latter should be gone over with a roller, so as to break the clods and secure a firm and even surface A certain amount of shade is beneficial, both for the growth of the grass and for affording shelter to cattle from the sun. Therefore, existing trees should be left at suitable distances apart or, where these are wanting, good shade trees should be planted. Pastures may be formed by sowing seed or by planting roots or cuttings of suitable grasses at a few inches apart. When the former method is adopted, a good seed mixture, including a proportion of herbaceous leguminous or clover-like plants, should be procured, the seed being sown broadcast and afterwards raked or harrowed into the soil. A suitable mixture has the effect of keeping down weeds in addition to furnishing the best pasturage. Most perennial grasses are easily propagated by division of the roots, which, if planted out in wet weather at distances of 6 to 8 inches apart, should cover the ground in a short space of time.

Upkeep of Pastures.—For the subsequent maintenance of the pasturage, care must be taken to keep down coarse weeds or woody growths which are liable to appear. An occasional surface dressing with a fertilizer is most beneficial and well repays the cost and trouble. Irrigation above all things, especially in dry seasons, may be said to be the secret of success in the upkeep of green pastures. In Australia, America, South Africa, etc., irrigation not only increases the yield, but also improves greatly the feeding qualities of pasture or fodder.

Pasture among Tree Products.—The growing of pastures between certain perennial or tree crops, as on coconut plantations, is sometimes practicable, and at the same time beneficial to the main

crop. A well-tilled condition of the soil between the trees aids the retention of moisture, while the light filtering shade afforded by the trees favours the production of tender herbage.

Pasture and Fodder Plants in Ravines, Patanas, Compounds, etc.—On estates there are often ravines, strips of private roadsides, unopened forests or jungle, etc., which, though regarded as waste ground, might be utilized for the growth of pasture or forage plants. Unopened forests or jungle in many cases need only have the tangle of undergrowth removed to afford the necessary conditions for good pasturage. Patanas and chena land might also be reclaimed in many places and utilized for pasturing, while native compounds or so-called gardens could be much improved by clearing away the useless undergrowth and encouraging the growth of fodder or herbage under the shade of coconuts, jak trees, etc., —a factor which should also conduce to the improvement of local sanitation and the reduction of malaria. Under the seapage of tanks or reservoirs there are often considerable areas which might well be utilized for grazing purposes or for growing green fodder, the moisture and nature of the soil in such localities being usually well adapted to this purpose.

Fallow Rice Fields and Conservation of Fodder.—After reaping a harvest of rice, the goiya (Sinhalese farmer) usually leaves his fields bare for a considerable period, in some cases abandoning them for several years. If these were re-irrigated and planted under intercrops of leguminous plants, the latter would not only provide feed for cattle during the dry season, but would also have the effect of renovating the soil. In some countries it is customary to make provision for seasons of scarcity by converting surplus grass or fodder into hay or ensilage. Ensilage has the advantage of conserving forage plants in their green nourishing state, and keeps good for several years. The method of procedure is simple, a pit (called a silo) sufficient to hold from 25 to 50 tons or more of green forage being excavated, and the earth so removed placed on top of the mass so as to act as a covering and a weight at the same time.

SELECTED FODDER GRASSES

The suitability of grasses for fodder purposes depends in many cases on the extent of care bestowed on their cultivation. It is well known that the same kinds of grasses do not succeed equally well in all localities, and that certain species are more suited to some districts than others. English grasses, it may be said, are seldom, if ever, a success in the tropics, and even at the

higher elevations they invariably become, in course of time, replaced by local species. The most important fodder grasses grown in Ceylon are the "Guinea grass" (*Panicum maximum*) and "Mauritius-grass" (*P. barbinode*) in the low-country, and the "Golden Crown-grass" (*Panicum dilatatum*) up-country.

The following selections are given alphabetically :—

Andropogon (Sorghum) halepensis. Johnson-grass or Cuba-grass. A tall handsome perennial with creeping rhizomes, common all over India. It is esteemed for green fodder and for hay, and is largely grown in

Field of "Mauritius"- or "Water"-Grass (*Panicum barbinode or P. muticum*), on Experiment Station, Peradeniya, Ceylon.

India, Southern United States, and Australia. In India the seed is collected and eaten by the poorer classes.

Anthistiria australis (= A. imberbis). The "Kangaroo-grass" of Australia, common also in Ceylon, India, and East Africa. It is a perennial, growing about 3 ft. in height, and in Eastern Australia is regarded as perhaps the most useful of the indigenous grasses. Stock of all kind are fond of it. In East Africa also it is considered excellent for green forage and for making hay.

Anthistiria Cymbaria. "Karawata mana," S. An abundant grass in the patanas of upper Dimbula. FERGUSON states: "Often cut and dried for fodder

for cattle, being perhaps the best substitute for hay of all the grasses found in Ceylon."

Astrelba pectinata. "Mitchell Grass." A perennial, 2 to 3 ft. high, native of Queensland, highly esteemed as a fodder grass.

Cymbopogon (Andropogon) pertusus. A common grass in Ceylon, from the sea-coast up to about 2,000 feet elevation; excellent for fodder either in a green or dry state, and cattle are very fond of it.

Cynodon Dactylon; "Doob" or "Doub-grass;" "Bahama-grass;" "Bermuda-grass;" Arugam-pillu, *T.* A prostrate perennial species, found in all tropical countries, especially in the drier regions. It resists extreme drought, and

GUINEA GRASS ON RIVER BANK, PERADENIYA.

is an important grass for covering bare barren land in dry districts or near the sea. Excellent for fodder or hay; in British Guiana it gave a crop, on experiment, of 22 tons green fodder per acre, in 12 monthly mowings. Easily propagated by cuttings or seed. Specially suited to dry districts. Forms a good sward, and in India, Egypt, etc., is a favourite lawn grass.

Eragrostis abyssinica. Known as Teff, Jtheff, or Thaff. An Abyssinian grass, cultivated for its grain as well as for fodder. It is highly spoken of as a grass for dry regions.

Euchlaena (Reana) luxurians. Teosinte. A tall annual grass from Guatemala, and one of the most prolific of fodder plants. Under favourable

conditions it grows from 10 to 15 feet in height and yields very large crops. At Madras, under irrigation, a single crop gave a yield of about 20 tons per acre; the crop for the year may be 50 to 80 tons. Cattle and horses are very fond of it.

Ischaemum ciliare. "Rat-tana," *S*; "Nandu-kanni," *T*. A common perennial grass, found at all elevations in Ceylon. At one time commonly grown under the shade of coconuts near Colombo and brought into town as a fodder for cattle.

Ischaemum muticum. A common grass in damp situations near Colombo, large quantities of it, according to FERGUSON, "being collected by the grass-women for horse food in Colombo." In the jungle, where it obtains support, it is a tall grass and grows to several feet in height.

Ischaemum timorense (=Spodiopogon obliquivalvis). A slender straggling grass, common in the low-country, usually inhabiting damp and shady places; an excellent plant for green fodder. MR. JOWITT has pointed out that this grass is remarkable for its aerial roots, which become embedded in gelatinous matter during the monsoon rains.

Panicum Burmanni. Pagister grass, or Scotch grass of the West Indies.—It is found chiefly in wet land, and so prolific is it that a single acre is recorded to be "sufficient to maintain five horses for a whole year."

Panicum Crus-galli. Cockspur-grass, "Wel-marukku," *S*. An annual grass, of which there are several varieties, 1½ to 3 ft. high, found in the low-country of Ceylon and throughout the tropics. An excellent fodder, especially esteemed in Queensland. WATT describes one variety of this in India as the quickest growing of all the millets, being harvested in some localities within six weeks of being sown.

Panicum maximum. Guinea grass, "Rata-tana," *S*. This well-known species constitutes one of the best fodder grasses of the tropics. In Ceylon it holds first place as regards the low-country. It has been introduced here from tropical Africa, and thrives best on deep alluvial moist soil, flourishing from sea-level to about 3,000 feet or higher. Near Colombo, it may be seen thriving on almost pure sand, sometimes reaching a height of 4 to 6 feet. Under good cultivation it can be cut four or five times a year, each cutting capable of yielding, it has been estimated, 20 tons or more per acre. Seldom produces seed here, but is readily propagated by division.

Panicum barbinode (=P. muticum). This is known by various names, as Mauritius-, Para-, Water-, and Buffalo-grass, also "Diya-tanakola," *S*. It is a somewhat coarse, vigorous plant, thriving and spreading rapidly in damp places, often taking complete possession of the soil. It has rather succulent stems and leaves, with the nodes distinctly hairy, and roots readily at the joints; the latter are said to grow after passing through animals. In Ceylon, where it is naturalised at the lower elevations, it may be considered as ranking next in importance to the Guinea-grass, whilst it is also much grown in other tropical countries, as the West Indies, Florida, Mauritius, and Bengal. It is a native of tropical America, and was introduced to the Eastern tropics about 1850.

Panicum repens. "Et-tora," *S*. A widely distributed grass, common in Ceylon from sea-level to 6,000 feet elevation, and thriving equally well in dry sandy soil as in marshes. On some estates it is a common weed, albeit an excellent fodder for cattle, and large quantities of it used to be brought into Colombo for this purpose.

Panicum spectabile. "African Wonder Grass;" "Capim-de-Angola." A valuable fodder plant, long established in Brazil and other parts of tropical America, supposed to have been first introduced from the west coast of Africa. It is distinguished by long broad leaves, softly bearded nodes, and grows 5 to 6 feet in height. Readily propagated by division; prefers moist situations and spreads rapidly when once established.

Paspalum dilatatum, known as the Hairy-flowered Paspalum, Golden-crown, etc. A useful perennial grass, indigenous to South America, introduced into Australia some years ago and into India and Ceylon about 1900; much relished by cattle. Suited only to the higher elevations, say, 3,000 to 6,000 feet. Flourishes in any good soil, and is estimated to yield 10 tons or more of green forage per acre. Excellent for binding railway banks and for similar purposes. It has a tendency to grow in clumps, attains a height of from 18 to 24 inches, and is easily propagated by roots, cuttings, or seed.

Setaria imberbris. A tall grass of East Africa, where it is considered a good forage plant.

Setaria verticillata. A perennial grass found in abundance in some of the hot and dry districts of Ceylon; also in East Africa, where it is considered a good forage plant when young. The grass is remarkable for its power of resisting severe droughts.

Sorghum vulgare (=*Andropogon sorghum*). Guinea-corn, the Indian or Great millet. A tall handsome grass, extensively cultivated in India and other tropical countries, chiefly for its grain. Some varieties are specially grown for green forage, being cut when two-thirds grown. There are several varieties, some producing in four cuttings from 20 to 30 tons per acre.

Sporobolus indicus. A perennial grass, 2 to 3 feet high, common throughout Ceylon and other tropical countries. Grows luxuriantly on thin soil, and in the young state affords good forage.

Stenotaphrum complanatum. A semi-creeping leafy grass, 1 to 1½ ft. high, with smooth glabrous leaves. Thrives best on moist banks or under the partial shade of trees.

Tricholaena rosea. Natal red-top Grass. An elegant perennial grass, 1½ to 2 ft. high, with pinkish flowering panicles, introduced from Natal, where it is much valued for fodder as well as for pasture. Thrives at medium and high elevations.

Zea Mays. Maize; Indian-corn; "Bada-iringu," *S.* This quick-growing crop, though usually cultivated for its grain, is sometimes used for green forage, being cut when about two-thirds grown. It is a most productive crop, a well-cultivated patch being known to produce about 60 tons of green fodder per acre.

OTHER FODDER PLANTS

For feeding, dairying, or fattening purposes it is desirable to vary the grass diet of cattle by mixing with it other nourishing herbage in suitable combination. The following plants, though

unsuitable for close grazing, may be found useful for this purpose :—

Alyssicarpus vaginalis. "Aswenna," *S.* A leguminous straggling perennial, common in the low-country, more especially in the dry region. Much relished by cattle.

Amarantus gangeticus. "Sudu-tampala," *S*; Chirukirai, *T.* A succulent plant, 2 to 3 feet high, common in the low-country and throughout the tropics, often cultivated in native gardens as a curry vegetable.

Chou Moellier, Chou de Burghley, or Cabbage Broccoli. Considered to be a cross between the Cabbage and Broccoli ; attains a height of 4 to 6 ft. It possesses to some extent the characteristics of both these, and may be used either as a vegetable or as feed for stock. It is more specially as a fodder plant that it is cultivated, the leaves being broken off from the stem from time to time ; but it is also sometimes grown as a vegetable. MR. DRIEBERG informs me that it has become a popular vegetable in some school-gardens in the low-country, growing to a height of 6 ft. or more.

Commelina benghalensis. "Diya-meneriya," *S.* A slender succulent herb with creeping stems and bright blue flowers, common at low elevations in Ceylon and elsewhere in the tropics. Cattle eat it with relish.

Desmodium gyrans. "Chanchala," *S.* ; also called the "Telegraph plant" (from the rotary motion of the two lateral leaflets, resembling semaphores). An erect leguminous perennial, about 2 ft. high, indigenous to the moist low-country up to about 3,000 feet.

Glycine hispida. Soya-bean. In sub-tropical countries, where this annual thrives and grows to several feet in height, it furnishes valuable fodder either in the green or dry state. See *Tropical Vegetables.*

Hedysarum coronarium. Soola, or Sulla-clover. A leguminous plant, 2 to 3 feet high, much esteemed in Australia for green forage. Said to give a yield of 40 to 50 tons per acre. Thrives best in moist, deep, calcareous soil.

Pithecolobium (Inga) saman. Rain tree ; Peni-karal, *S.* The thick sugary pods of this well-known shade tree are very nutritious and much relished by cattle. They resemble the Locust-bean of commerce, and in South America are collected and exported for cattle food, being esteemed in Europe for fattening purposes.

Ipomoea aquatica. "Kankun," *S.* A small herbaceous creeper with succulent stems and leaves, commonly found in the low-country in wet places. The leaves are used as a curry vegetable by the Natives.

Medicago sativa. Lucerne or Alfalfa. This well-known and much esteemed leguminous forage plant is not, unfortunately, as a rule suited to the tropics, except under irrigation ; even in sub-tropical countries irrigation is generally essential. It has been grown with moderate success at Hakgala Gardens, Ceylon, where however the cost was out of proportion to the value of the crop. It should be sown in drills, thus requiring about 6 to 8 lb. to sow an acre.

Mucuna utilis (= Sticilobium deeringianum). Velvet-bean. An annual, rapidly growing bean, with short, black velvety pods. This and similar free-growing beans are valuable fodders, and are extensively grown both for

this purpose and for renovating the soil in the Southern United States and elsewhere.

Polygonum. An extensive genus of leafy creeping or erect herbs, sometimes large shrubs, found throughout warm countries, etc., usually inhabiting wet places. Some ten species are indigenous to Ceylon, several being relished by cattle.

Trifolium alexandrinum. Berseem, or Egytian clover (*Leguminosae*). A perennial clover, much esteemed and extensively cultivated in Egypt, especially in arid salt lands where little or nothing else will thrive. Here it flourishes, and affords the principal green food for cattle, horses, camels and donkeys ; it is also valued for grazing as well as for reclaiming infertile brackish land.

PASTURE PLANTS.

Grasses are not as a rule equally well adapted for fodder and pasture, many of the fodder class being unsuited for close grazing or pasturing. Some of the foregoing species may, however, be also included under this head.

Bromus unioloides. "Prairie-grass." A good pasture and hay grass in Australia. Thrives best on moist heavy soils.

Chrysopogon (Andropogon) aciculatus. "Tutteri," *S*; "Love-grass." A perennial, very common in Ceylon up to 4,000 ft. Resists drought well, forms good grazing, also a good sward. See under *Lawns*.

Cynodon Dactylon. Doob-, or doub-grass. See *Fodder Grasses*.

Desmodium heterophyllum. "Maha-undupiyali," *S*. (Leguminosae). A perennial prostrate herb, with pale purple flowers, common in the low-country up to 2,000 feet. Forms an excellent constituent of pastures and grows in shade or in the open.

Desmodium triflorum. "Hin-undupiyali," *S*. A very small perennial herb, similar to the latter species, but with finer foliage and bright purple flowers. Very common in the low-country ; forms a beautiful close sward.

Eleusine indica. "Wal-mal-kurakkan," *S*. An annual grass, forming good pasture, common in most districts in Ceylon.

Eragrostis tenella. A slender annual spreading grass, of which there are many forms. Found all over the low-country.

Ischæmum ciliare. "Rat-tana," *S*. See *Fodder Grasses*.

Justicia procumbens. "Mayani," *S*. (*Acanthaceae*). A prostrate spreading herb, commonly found among grass in the moist region, at all elevations.

Oplismenus (Panicum) compositus. A slender creeping grass common in the low-country, flourishing especially under the shade of trees. Of this there are several varieties.

Panicum curvatum. An elegant slender grass, common in the low-country of Ceylon, also in South India, Madagascar, etc. It is a good pasture or forage plant and, according to FERGUSON, used to form a large proportion of the fodder collected near Colombo for horses.

Panicum prostratum. "Samay-pillu," *T*. A slender creeping grass, common in the hotter parts of Ceylon and much relished by cattle.

Panicum repens. "Et-tora," S. See *Fodder Grasses.*

Panicum scrobiculatum. Of this grass there are several forms, many with distinct Sinhalese names. It is common from sea level to 6,000 feet, resists drought well and cattle are fond of it.

Paspalum conjugatum. Known in Ceylon as the "Barbados sour-Grass," and in the Philippines as "Bitter" or "Buffalo" Grass. A slender leafy grass, introduced from the West Indies, now common in the low-country along roadsides and in moist situations. It is specially adapted to shady places, spreads rapidly, and frequently takes complete possession of the ground. Suited up to 3,000 feet.

Paspalum dilatatum. See *Fodder Grasses.*

Paspalum (Digitaria) longiflorum (=P. filiculme). A very slender perennial creeping grass, common from the sea shore up to 3,000 feet or more. Resists drought well, and is often the first grass to become established on new clearings in the low-country; it forms a large proportion of the swards about Colombo. At Peradeniya it is an excellent lawn grass.

Paspalum sanguinale. "Gurwal," S. One of the most common grasses in Ceylon, forming excellent pasture; much relished by cattle.

Paspalum obtusifolium. A perennial grass, introduced from Mexico, naturalised in Ceylon and very common about Peradeniya under the shade of trees, often to the exclusion of all other grasses; distinct by its broad sinuate leaves; excellent for grazing.

Pennisetum cencrhoides. Congayam grass. A perennial, 10 to 12 in. high, specially suited to dry districts. Said to afford good fodder and pasture in South India.

Sporobolus diander. A moderate-sized grass, common throughout Ceylon and the Eastern tropics generally.

Ruellia ringens. "Nil-puruk," S. (*Acanthaceae*). A perennial straggling herb, commonly found among grass in the low-country.

BROWSE (OR FAMINE) FODDER PLANTS

In times of scarcity of food, as during a prolonged and severe drought, cattle or stock will eat almost anything that is green or juicy. Thus even the gorse, the prickly-pear, rubber trees, tea bushes and palm leaves may be consumed with relish. The following may be mentioned as among the principal plants which are of importance in such circumstances :—

Atriplex nummularia. Salt-bush (*Chenopodiaceae*). This and other species of Atriplex, which are perennial bushy plants and thrive in arid districts or on sandy soil near the seacoast, form an important food for stock in Australia and elsewhere in periods of drought.

Atriplex repens. "Elechivi," *T.* A small prostrate succulent shrub, common on the sandy shores in the dry region of Ceylon and South India. The Tamils of Jaffna eat the leaves as a vegetable.

Cytisus proliferus. Tree-lucerne; Tagasaste. A small leguminous tree, indigenous to the mountains of the Canary Islands, where the leafy branches are used largely as food for cattle. Suitable to a dry climate and loose sandy soil.

Mikania scandens (*Compositae*). This annual herbaceous climber, introduced from Malay and now commonly naturalised in the low-country of Ceylon, yields a quantity of green fodder which is relished by cattle at all times, especially in the dry season when food is scarce.

Opuntia Dillenii. Prickly-pear. (*Cactaceae*). This and other species of Opuntia, which have become a serious pest in certain countries, notably in Queensland, are often turned into a palatable food for stock in times of scarcity. It is best when boiled or crushed and used with ensilage or other fodder, and in this way is said to have a fattening effect on cattle. A spineless form, raised by the late Mr. Burbank in California, is highly spoken of by some.

Prosopis juliflora. Mesquit-tree; Cashaw, or Algaroba Bean. A leguminous tree of tropical America, the leaves, shoots, and pods of which are used to feed cattle. In dry weather the pods are said to be as nutritious as corn.

Prosopis pubescens is the "Screw mesquit," a tree of similar value to the above, found in Texas and Mexico.

PRINCIPAL PLANTS USED IN NATIVE MEDICINE IN CEYLON.

Botanical and Native Name.	Natural Order.	Purposes for which used.
Abrus precatorius. Olindawel, *S.* Indian liquorice.	*Leguminosae*	Juice of green leaves used for purifying the blood; root taken for sore throat and rheumatism.
Abutilon asiaticum. Anoda, *S.*	*Malvaceae*	Root a tonic, also used for piles.
Acalypha indica. Kuppaménya, *S.*	*Euphorbiaceae*	Vermifugal and carminative, also externally applied to sores.
Achyranthes aspera. Karalsébo, *S.*	*Amarantaceae*	Juice of leaves used for dysentery.
Acorus Calamus. Wada-kaha, *S.*	*Araceae*	Used in bowel complaints of children.
Adhatoda vasica. Adatoda, *S.*	*Acanthaceae*	Whole plant used in diseases caused by excessive phlegm; also in menorrhagia.
Aegle Marmelos. Béli, *S.*	*Rutaceae*	Root, bark and leaves used in flatulency. The unripe fruit boiled, and then baked under hot ashes, checks diarrhœa and dysentery; also boiled and juice taken for chronic diarrhœa. Ripe fruit cooling and laxative, taken for piles.
Aerva lanata. Pol-kudupala, *S.*	*Amarantaceae*	Much employed in coughs and as a vermifuge for children.
Aloe vera. Green aloes.	*Liliaceae*	Fresh juice of leaves cathartic and cooling; used in fever, spleen and liver troubles, also in eye diseases.
Alternanthera triandra. Mukunuwenna, *S.*	*Amarantaceae*	A local cooling application for giddiness
Areca Catechu. Puwak, *S.*	*Palmae*	Applied externally to ulcers and for strengthening the gums, also given for worms in animals.

S.=Sinhalese; *T.*=Tamil.

Botanical and Native Name.	Natural Order.	Purposes for which used.
Asparagus falcatus. Hathawariya, *S.*	*Liliaceae*	Tuberous roots commonly used in cooling medicines, also for venereal diseases, etc.
Azadirachta indica. Kohomba, *S.*	*Meliaceae*	Juice of leaves for injuries to the eyes and for intestinal worms. Fruit a vermifuge and purgative; oil from seed for rheumatism.
Brassica juncea. Aba, *S.* Mustard.	*Cruciferae*	Seeds pungent, used as poultice in gout and inflammation; leaves promote appetite.
Brucea sumatrana.	*Simarubaceae*	Decoction of leaves taken for dysentery. An introduced plant, naturalised in Ceylon.
Caesalpinia Bonduc. Kumburu-wel, *S.*	*Leguminosae*	Tender leaves for toothache; also for worms in children.
Calophyllum Inophyllum. Domba, *S.*	*Guttiferae*	Kernel of fruit for ulcers and hoof disease of cattle; root and bark for rheumatic pains.
Calotropis gigantea. Wara, *S.*	*Asclepiadeae*	Green leaves applied locally to dispel swellings Root a tonic. Milk of the plant taken internally for leprosy.
Cardiospermum Halicacabum. Penela-wel, *S.* Muda-cottam, *T.*	*Sapindaceae*	Roots and leaves used as an aperient, also as hair wash.
Caryota urens. Kitul, *S.*	*Palmae*	Bark and root applied to cuts and wounds.
Cassia auriculata. Ranawara, *S*; Matara Tea.	*Leguminosae*	Bark and root used as an alterative; dried leaves used as tea.
Cassia Fistula. Ehela, *S;* Pudding-pipe.	,,	Tender leaves as a mild purgative in rheumatic fever; bark astringent, used with other medicines for rheumatism.
Celastrus paniculata. Duhudu, *S.*	*Celastraceae*	Bark considered to strengthen the brain and purify the blood; cures sores, etc.
Cannabis sativa. Cansa, *S*; Ganja; Bhang; Indian hemp.	*Urticaceae*	Juice of the leaves in composition with other medicine given as a vermifuge. Powerfully narcotic; leaves smoked, but now prohibited. Cultivation of the plant also prohibited in Ceylon.
Cissampelos Pareira. Diyamitta, *S.*	*Menispermaceae*	Roots used in fever and diarrhœa.
Cocos nucifera. Pol, *S.* Coconut.	*Palmae*	Oil applied to head for cooling. Pulp of young fruit given in sun-stroke. Roots for strengthening the gums, etc.
Coleus aromaticus. Kapprawalliya, *S.*	*Labiatae*	Used in asthma, chronic coughs, etc.
Cratœva Roxburghii. Lunu-warana, *S.*	*Capparidae*	Leaves for gouty swellings. Bark to sharpen the appetite.
Croton Tiglium. Jayapala, *S;* Croton-oil plant.	*Euphorbiaceae*	Seeds a powerful purgative; poisonous. Source of Croton-oil.
Curcuma Longa. Kaha, *S.*	*Scitamineae*	Used in skin diseases, also in ophthalmia.
Cyperus rotundus. Kalanduru, *S.*	*Cyperaceae*	Tubers given in fever, diarrhœa, dyspepsia and stomach complaints.
Dæmia extensa. Medahangu, *S.* Veliparatti, *T.*	*Asclepiadaceae*	Emetic, given as an expectorant in bronchitis.

Botanical and Native Name.	Natural Order.	Purposes for which used.
Datura fastuosa. Attana, *S.*	*Solanaceae*	Roots used in bites from mad dogs; supposed to cure insanity; whole plant dried and smoked as tobacco for asthma. Poisonous.
Eclipta erecta. Kikirindia, *S.*	*Compositae*	Used to purify the blood.
Embelia Ribes. Wal-embilla, *S.*	*Myrsineae*	Bark and leaves acid and astringent, taken for boils and skin diseases.
Emilia sonchifolia. Kadupara, *S.*	*Compositae*	Used for cuts and wounds.
Erythoxylon lucidum. Bata-kirilla, *S.*	*Linaceae*	Leaves chewed to expel worms, also to appease hunger.
Evolvulus alsinoides. Visnukranti, *S.* Vichnu-kiranti, *T*	*Convulvul-aceae*	Bitter tonic and febrifuge.
Feronia elephantum. Diwul, *S.*	*Rutaceae*	Green fruit checks diarrhœa; ripe fruit taken for kidney and throat affections.
Ficus religiosa. Bo-gaha, *S.*	*Urticaceae*	Juice of bark as a mouth-wash for tooth-ache and for strengthening the gums.
Garcinia gambogia. Goraka, *S.*	*Guttiferae*	Bark and leaves for constipation; also used to heal cuts and wounds.
Gynandropsis pentaphvlla. Wéla, *S.*	*Capparideae*	Reputed cure for cobra-bite; also used for earache, toothache, etc.
Gynura pseudo-China. Ala-bèth, Chena-ala, Mul-bèth, *S.*	*Compositae*	Tuberous roots largely used in cooling medicines, also for leprosy.
Hemidesmus indicus. "Iramusu." *S*: Indian Sarsaparilla.	*Asclepideae*	Root to purify the blood.
Herpestis Monnieria. Lunuvila, *S*		Whole plant used as a mild purgative for children; also as fomentation for erysipelas and elephantiasis.
Hibiscus micranthus. Perumaddi, *T.*	*Malvaceae*	A valuable febrifuge. (TRIMEN).
Hydrocotyle asiatica. Gotu-kola, *S.*	*Umbelliferae*	A good tonic, chiefly for children. Purifies the blood, promotes digestion, and cures nervousness; also used for dysentery.
Hygrophila spinosa. Katu-ikiri, *S.*	*Acanthaceae*	Whole plant used in diabetes.
Ipomœa Turpethum. Trastawalu, *S.*	*Convulvul-aceae*	Roots used in fever, dropsy, etc.
Ixora coccinea. Ratmal or Ratambala, *S.*	*Rubiaceae*	Flowers and bark used for bloodshot eyes; leaves for sores, ulcers, etc.
Justicia Betonica. Sudhu-puruk	*Acanthaceae*	Leaves used as a poultice to boils.
Lasia spinosa. Kohila, *S.*	*Araceae*	A common remedy for piles.
Lasiosiphon eriocephalus. Naha, *S.*	*Thymelae-aceae*	Bark used externally.
Limonia alata. Tumpat-kurundu, *S.*	*Rutaceae*	Leaves and bark used in fomentations for rheumatic pains.
Mimusops Elengi. Munamal, *S.*	*Sapotaceae*	Bark used for decaying gums; also for snake bite.
Modecca palmata. Hondala, *S.*	*Passi-floraceae*	Juice of the leaves and roots used externally for skin diseases. Fruit poisonous.

[*S.*=Sinhalese; *T.*=Tamil].

Botanical and Native Name.	Natural Order.	Purposes for which used.
Moringa pterygosperma. Murunga, *S*; Horse-radish Tree.	*Moringae*	Bark, leaves and root acrid and pungent; juice taken internally to promote appetite and help digestion; used externally as a rubefacient.
Munronia pumila. Bin-Kohamba, *S*.	*Meliaceae*	Whole plant very bitter, used in cases of debility and remittent fever. A good substitute for the tonic "chiretta."
Musa Plantain or Banana	*Scitamineae*	Juice taken as an antidote for snake-poison.
Nelumbium speciosum. Nelun, *S*.	*Nymphaeaceae*	Stem used in intermittent fever and dysentery. Stamens for bleeding piles and in parturition.
Ocimum sanctum. Maduru-tala, *S*.	*Labiatae*	Fragrant and aromatic, used in decoctions for cough and catarrh, sometimes chewed as a substitute for betel.
Oroxylum indicum. Totilla, *S*.	*Bignoniaceae*	Bark a bitter tonic; checks fever, diarrhœa, etc
Oxystelma esculentum. Kulappalai, *T*.	*Asclepiadeae*	As a cure for hydrophobia.
Phyllanthus Emblica. Nelli, *S*.	*Euphorbiaceae*	Fruits a cooling laxative, used in dyspepsia.
Piper Betle. Bulat-wel, *S*; Betel-leaf.	*Piperaceae*	Carminative and stimulant; a common masticatory.
Plectranthus zeylanicus. Iri-variya, *S*.	*Labiatae*	Whole plant aromatic; used as a carminative, blood-purifier, etc.
Plumbago rosea. Rat-nitul, *S*. **P.—zeylanica.** Ela-nitul, *S*.	*Plumbagineae*	Roots commonly used for illegal purposes.
Piper longum. Tippili, *S*.	*Piperaceae*	Roots and dried flower-spikes used in cough, hoarseness and dyspepsia.
Pongamia glabra. Magul-karanda, *S*.	*Leguminosae*	Root used as a tooth-brush. Juice of root-bark for sores, etc.
Punica granatum. Delun, *S*; Pomegranate.	*Lythraceae*	Fruit-rind used for diarrhœa. Leaves boiled and used as eye-wash.
Randia dumetorum. Kukuruman, *S*.	*Rubiaceae*	Root used for diarrhœa and biliousness.
Ricinus communis. Tel-endaru *S*. (Castor Oil)	*Euphorbiaceae*	Oil commonly used as a purgative.
Saccharum officinarum. Sugar-cane.	*Gramineae*	Juice commonly used in decoctions.
Sesamum indicum. Ella, *T*. Tel-tala or Wal-tala, *S*.	*Pedaliaceae*	Oil used for cooling the body. Seeds pounded with jaggery to purify the blood.
Solanum indicum. Tibbatu, *S*.	*Solanaceae*	Used for catarrhal fever, asthma, etc.
S.—xanthocarpum. Ela-batu, *S*.	"	(Used for catarrhal fever, asthma, etc.)
Spilanthus Acmella. Akmella, *S*.	*Compositae*	Leaves and flowers used for toothache and sore throat, also to check diarrhœa of women at child-birth.
Strychnos Nux-vomica. Nux-vomica; Goda-kaduru, *S*.	*Loganiaceae*	Bark and seeds used as tonic in nervous debility, rheumatism, etc. Poisonous.

S=Sinhalese; *T*=Tamil.

Botanical and Native Name.	Natural Order.	Purposes for which used.
S.—potatorum. Ingini, *S.*	*Loganiaceae*	Seeds not poisonous; rubbed on inside of vessels, they have the effect of clearing muddy water.
Tamarindus indica. Tamarind. Siyambala, *S.*	*Leguminosae*	Tender leaves used as poultices for boils, also as fomentations; seeds used for chronic diarrhœa.
Tephrosia purpurea. Pila, *S*; Kavilai, *T.*	,,	Common village medicine for children. (TRIMEN).
Terminalia Chebula. Aralu, *S.*	*Combretaceae*	Bark of nut good for fever, asthma, chronic diarrhœa, heart and skin diseases.
T.—belerica. Bulu, *S.*	,,	Nuts very astringent, used in eye diseases, etc.
Tinosperma cordifolia. Rasa-kinda, *S.*	*Menispermaceae*	Stem used in fever, skin diseases, jaundice, and syphilitic affections.
Trichadenia zeylanica. Tolol or Titta, *S.*	*Bixaceae*	Oil from seed used in skin diseases, and for burning.
Trichosanthes Cucumerina. Dummella, *S.*	*Cucurbitaceae*	Roots used for expelling intestinal worms, leaves and stems for bilious disorders, cutaneous diseases, and as an emmenagogue.
Vernonia anthelmintica. Sanni-nayan, *S.*	*Compositae*	Used in fever with convulsions, etc.
V.—cinera. Monara-kudumbia, *S*.	,,	Wounds and sores; taken internally to promote perspiration.
Vitex Negundo. Nika. *S.*	*Verbenaceae*	Leaves, bark and root used in toothache and rheumatism, in eye diseases, and as a tonic; carminative and vermifuge.
Withania somnifera. Amukkara, *S.*	*Solanaceae*	Used for cough and asthma.
Zingiber officinale. Ginger. Inguru, *S.*	*Scitamineae*	A well-known stimulant stomachic and aromatic; used in indigestion and fever, etc.

EDIBLE HERBS, ETC., COMMONLY USED AS FOOD IN CEYLON BY THE POORER NATIVES, BUT NOT CULTIVATED

Botanical and Common Name.		Natural Order.	Parts Used.
Acalypha indica.	Kuppamaniya, *S.*	*Euphorbiaceae*	Leaves
Achyranthes aspera.	Gas-karal-heba, *S.*	*Amarantaceae*	,,
Acrostichum aureum.	Kerè-koku, *S.*	*Filiceae*	Tender fronds
Aerva lanata.	Pol-kudupala, *S.*	*Amarantaceae*	Stems and leaves
Allmania nodiflora.	Kumatiya, *S.*	,,	Leaves
Alternanthera triandra.	Mukunu-wenna, *S.*	,,	Tender stems and leaves
Amarantus gangeticus.	Sudu-tampala, *S.*	,,	,,
A.—polygonoides.	Kura-tampala, *S.*	,,	,,

S.=Sinhalese. *T.*=Tamil.

Botanical and Common Name.		Natural Order.	Parts Used.
A.—spinosus.	Katu-tampala, S.	*Amarantaceae*	Tender stems and leaves
Aponogeton crispum.	Kekatiya, S.	*Naiadeae*	Tuberous roots
Argyreia populifolia.	Giritilla, S.	*Convolvulaceae*	Tender leaves
Asparagus falcatus.	Hathawariya, S.	*Liliaceae*	Young shoots and roots
Asplenium esculentum.	Miwana-kola, S.	*Filiceae*	Tender fronds
Boerhaavia diffusa.	Peta-sudupala, S.	*Nyctagineae*	Leaves
Cassia occidentalis.	Peni-tora, S.	*Caesalpineae*	Leaves and flowers
C.—tomentosa.		,,	L. and fl's commonly eaten up-country
C.—Tora.	Peti-tora, S.	,,	Leaves and flowers
Celosia argentea.	Kirihenda, S.	*Amarantaceae*	Stem and leaves
Ceratopteris thalictroides.	Kudamahu-weralla, S.	*Filiceae*	Succulent fronds
Commelina benghalensis.	Diya-meneriya S.	*Commelinaceae*	Stems and leaves
C.—clavata.	Girapala, S.	,,	,,
Costus speciosus.	Tébu, S.	*Scitamineae*	Tuberous roots
Cycas circinalis.	Madu, S.	*Cycadeae*	Sago from seeds
Dregia volubilis.	Kiri-anghuna, S.	*Asclepiadeae*	Leaves
Gynandropsis pentaphylla.	Wèla, S.	*Capparideae*	,,
Hibiscus furcatus.	Napiritta, S.	*Malvaceae*	Tender leaves
Hydrocotyle javanica.	Maha-gotukola, S	*Umbelliferae*	Stalks and leaves
Impatiens flaccida.	Kudalu, S.	*Geraniaceae*	Stem and leaves
Ipomœa acquatica. And other species of Ipomoea.	Kankun, S.	*Convolvulaceae*	,,
Klugia notoniana.	Diya-nilla, S.	*Gesneraceae*	Leaves
Lasia spinosa.	Kohila, S.	*Araceae*	Tender leaves
Leucas zeylanica.	Geta-tumba, S.	*Labiateae*	Leaves
Lippia nudiflora.	Herimenakola, S.	*Verbenaceae*	,,
Marsilea quadrifolia.	Diya-embulembeliya, S.	*Rhizocarpeae*	Stalks and leaves
Monochoria hastaefolia.	Diya-habarala, S.	*Pontederiaceae*	Tender stalks and leaves
Nasturtium officinale.	Kakutu-pala, S.	*Cruciferae*	Stems and leaves
Nelumbium speciosum.	Nelun, S.	*Nymphaeaceae*	Seeds
Nymphoea Lotus.	Olu, S.	,,	,,
Oxalis corniculata.	Hin-embul-embiliya, S.	*Geraniaceae*	Stalks and leaves
Pandanus odoratissima.	Rumpi, S.	*Pandanaceae*	Young leaves for flavouring
Polypodium quercifolium.	Baindaru, S.	*Filiceae*	Young fronds in bud
Portulaca oleracea.	Genda-kola, S.	*Portulacaceae*	Stems and leaves
P.—quadrifida.	Hin-genda-kola, S.	,,	,,
P.—tuberosa.	Urugenda-kola, S.	,,	,,
Solanum indicum.	Tibbatu, S.	*Solanaceae*	Tender fruits
S.—nigrum.	Kalukanweriya, S.	,,	Stalks and leaves
S.—xanthocarpum.	Ela-batu, S; Kandan-kathrikai, T.	,,	Yellow fruits
Rivea ornata.	Muchuddai, T.	*Convolvulaceae*	Fleshy flowers (Jaffna).
Typhonium trilobatum.	Panu-ala, S.	*Araceae*	Tender leaves

S.=Sinhalese; *T.*=Tamil.

EDIBLE FLOWERS IN THE TROPICS

Various flowers are edible and relished in different countries, either for flavouring or as an article of food. In Europe violets, primroses, pot-marigolds and other flowers are eaten as salads or in preserves, while in other countries rose-buds are esteemed in similar preparations. The following are some of the principal flowers used for food in tropical or sub-tropical countries :—

Abutilon esculentum.—Flowers commonly eaten as a vegetable in Brazil.

Banana.—Young flower heads commonly eaten as a vegetable in Ceylon, etc.; used in China for pickling.

Bassia latifolia. Illipi ; Mahwa ; Butter-tree. **B.—longifolia.** " Mee," *S.*	In India the fleshy flowers of both species, produced in February, are dried and eaten by the Natives ; the average annual yield per tree in India is estimated at about 200 lb.

Bombax malabaricum.—Red cotton-tree ; Katu-imbul, *S.* The fleshy calyces of the large red flowers, collected as they drop in January and February, are much relished as a curry vegetable by the Burmese.

Calligonum polygonoides. Phogalli.—Flowers eaten in Northern India, being made into bread or cooked with butter.

Hibiscus Sabdariffa. Rozelle—Cultivated for the fleshy persistent enlarged calyces, which are used for flavouring, also for making jelly.

Lilium Thunbergi.—The flowers form a choice culinary delicacy in China.

Rivea ornata. (Convolvulaceae). The fleshy flowers are eaten in the North of Ceylon.

Sesbania (Agati) grandiflora.—In Ceylon the flowers are much relished when boiled or fried. See *Tropical Vegetables.*

CHAPTER XXVII.

ENEMIES AND FRIENDS OF GARDENS AND ESTATES

GARDEN AND ESTATE ENEMIES:—

Besides destructive insects, there are numerous animal pests which the cultivator of the soil has to contend with in the tropics. The following are the principal enemies in Ceylon which come under this head.

Squirrels.—These are sometimes very destructive in the low-country to fruits and edible seeds. They do considerable damage to cacao pods, mango fruits, pine-apples, etc., also to rubber nurseries by picking out and cracking the seed. Shooting, or driving them away is about the only practical remedy, unless recourse is had to poisoned baits.

Rats are very destructive, especially to coconuts and root-crops. Baits poisoned with arsenic is perhaps the best way of extirpating them. They may be prevented from climbing coconut palms and other trees by nailing a piece of tin, about 10 to 12 inches wide, on to the trunk of the tree.

Hares.—These, where they abound, do considerable damage in a garden. A fence of wire-netting is the best protection against them.

Civet- and palm-cats.—These are sometimes destructive to fruits, especially pine-apples. Watching for them at night and shooting them is perhaps the most practical remedy. The native watcher lures these animals by means of a light carried on his head; the light dazzles the cats and enables the watcher with his gun to come close up to his game.

Deer or elk.—In the hill districts these sometimes do a great deal of damage by browsing on all tender plants that come within their reach. A substantial wire-fence of about six strands serves as a barrier against them.

Porcupines.—These constitute perhaps the worst animal pest at Hakgala and other up-country gardens. They root up bulbs

and tubers of every description, doing serious damage in a single night. Poisoning and entrapping are the usual methods adopted for their destruction, but these appear to be seldom effectual. Spring-guns are apparently more effective, and Mr. Green, late Government Entomologist, informed me that, one beast which defied all his efforts for months fell a victim to a spring-gun the very first night it was set.

Wild-pig.—A very destructive animal in some districts, especially in Malay, to young rubber plantations and to food crops, as

FLYING FOXES,
as seen suspended from every branch, have completely defoliated the tree.

Cassava. Barbed-wire fencing around the field or shooting the animals are about the only remedies.

Cattle.—Trespassing cattle in many places in the low-country, are a most troublesome nuisance. Nothing short of a barbed-wire fence or a solid wall forms an effective barrier against them. Impounding when caught trespassing may tend to greater vigilance on the part of their owner.

Elephants sometimes commit serious depredations on estates or gardens, especially on young clearings or plantations, either by pulling up or trampling down the plants. A barbed-wire fence is the best protection.

Flying foxes (*Pteropus Edwardsii*).—These are often an annoyance in the low-country. They commit their depredations on ripening or fleshy fruits by night, and usually do a considerable amount of damage to the foliage of trees which they inhabit, sometimes

FLYING FOXES ON THE WING, PERADENIYA GARDENS.

entirely stripping and killing these. A net is the only safeguard against them. Frequent firing at them with a gun scares them away for a time.

Crows are sometimes formidable enemies to bulbs and certain young plants. The usual protective means is to shoot one occasionally, and hang it up where it is desired to scare others. It may sometimes be necessary to protect the plants or seeds with a net. A method adopted in California to prevent crows from

attacking corn or maize seed is to dip the seed in tar before sowing. (See *Journal of Economic Entomology, Aug. 1909*).

Sparrows and other birds.—Where these abound in great numbers they are a most destructive pest. They have a special fondness for tender annuals, and in a short time will do considerable damage by clearing off young seedlings. Stringing the seed-beds or rows with black cotton has often the effect of scaring them off, but nets are about the only reliable protection against them. In the case of seed-beds, it is recommended to dress the seeds, before sowing, with red-lead made into a thin paste with water. Among other grain-feeding birds, Mr. Green gives the following as the principal ones for Ceylon :—Weaver Bird (*Ploceus philippinus*), Black-bellied Munia (*Munia Malacca*), Spotted Munia (*Munia punctata*), White-backed Munia (*Munia striata*), Brown Munia (*Munia malabarica*), Ceylonese Lorikeet (*Loriculus indicus*), Alexandrine Parakeet (*Palæornis eupatrius*), Rose-ringed Parakeet (*Palæornis torquatus*).

Thieves.—These form a pest against which constant watch has to be kept. Unlike the other pests named, their depredations are not confined to edible products, but include anything movable. Catching them in the act and the infliction of a suitable punishment is not, unfortunately, always an effectual deterrent. Fruit crops especially, such as coconuts, cocoa, etc., are liable to attack by night thieves, and the employment of night-watchers is therefore indispensable. Dried coconut leaves tied round the stems of the trees (as often adopted in the low-country), give a loud rustling noise if a person attempt to climb the latter, and so give a warning of the presence of pilferers.

GARDEN AND ESTATE FRIENDS

Injurious insects, fortunately, have natural enemies which usually keep them in check, thus maintaining a balance in Nature. These should be encouraged, and may sometimes be introduced with success when not already present. The following are among the worst enemies of insects, and are therefore the best friends of gardens and estates. (See *Carnivorous insects*).

Insectivorous birds.—These play an important part in the prevention of insect pests by feeding on grubs, caterpillars, etc. It has been estimated that one bird, on an average, will consume at least fifty caterpillars a day, so that a family of five would account

for 250. Mr. Green, late Government Entomologist for Ceylon, gives the following as among the more useful insectivorous birds in Ceylon : (1) The Common Hawk Cuckoo (*Hierococcyx varius*), (2) Blue-Tailed Bee-Eater (*Merops philippinus*), (3) Black Drongo (*Buchanga atra*), (4) Ceylonese White-bellied Drongo (*Buchanga leucopygialis*), (5) Grey-Headed Fly-catcher (*Culicicapa ceylonensis*), (6) Magpie Robin (*Copyschus saularis*), (7) Grey-backed Titmouse (*Parus atriceps*), (8) Common White-eye (*Zosterops palpebrosa*), (9) Ceylonese White-eye (*Zosterops ceylonensis*), (10) Ceylon Myna (*Acridotheres melanosternus*), (11) Black Crow (*Corvus macrorhyncha*). Number 1 feeds principally upon caterpillars. No. 2 to 9 are generally insectivorous. The large species may often be observed taking toll of the winged termites when these are in flight. No. 10 and 11 frequent cattle and help to rid them of biting flies and ticks. The scarcity of bird-life in the higher districts of Ceylon has often been commented upon, and has been attributed, among other causes, to the felling of extensive tracts of forest land for growing tea, etc. One of the best means of encouraging the birds to increase is to extend the growth of trees or shrubs which produce fruit for bird-food, such as *Aberia* or Ceylon Gooseberry (Ket-embilla), *Antidesma*, *Bridelia*, *Duranta*, *Eugenia* (different species), *Ficus* (several species), Guava, Lovi-lovi, Mulberry, *Debregeasia* (Gas-dul) with orange-red berries, Wampi, Lantana, etc.

Carnivorous insects.—In maintaining the balance of insect life in Nature, there occur in various countries various insects of carnivorous habits, and these may as a rule be regarded as the friends of the cultivator. Amongst the most beneficial check-insects are the lady-bird beetles (*Vedelia*), which subsist on scale-bugs, etc.

Pollinating insects.—In the cultivation of fruits, flowers and vegetables, bees play an important part ; they carry the pollen from one tree to another, thus ensuring the fertilisation or cross-fertilisation of the plants, thereby making fruit and seed more plentiful than would otherwise be the case. A large number of plants are wholly dependent on insects for the fertilisation of their flowers. Thus the successful introduction and cultivation of the Symrna Fig, which is dependent on the Fig insect (*Blastophaga*) for the fertilisation of its flowers, in the United States, is due to the artificial introduction of this insect, the cultivation having previously proved a failure.

Frogs and Toads.—These are most useful creatures in the garden, for they destroy many injurious insects. In Europe and America toads are often specially protected and encouraged to multiply for the purpose of consuming beetles, snails, wire-worms, weevils, and other destructive insects. It is said that in England the value of toads in gardens is now so well recognised that a high price is sometimes paid for them for colonising purposes.

Lizards of all sorts are beneficial as well as interesting creatures in a garden. They feed mainly on beetles, grubs, etc., and therefore should be encouraged to multiply.

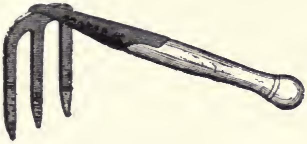
Rat-snakes are somewhat of a mixed blessing, most people having a repulsive feeling against all snakes. Yet rat-snakes in particular, which are harmless, are very destructive against rats.

NOXIOUS WEEDS AND MEANS FOR THEIR DESTRUCTION

Weeding, or the destruction of weeds, enters largely into the economy of garden and estate work in the tropics. A weed is generally defined as a plant out of place ; thus a plant which may be otherwise useful may become a weed. Any plant deemed a weed, in a garden, should of course be suppressed as far as practicable ; but on estates the proper degree of weeding and the best system of carrying it out are sometimes disputed points. Most planters believe in continuous clean-weeding, while others prefer periodical or annual weeding combined with tillage of the soil. Not only do weeds compete with the cultivated plants for light, air, and the soluble constituents of the soil, but they may also harbour insect pests and parasitic fungi. Weeds are usually provided with rapid means of natural distribution, their seeds being readily carried by the wind or by animals, or their tuberous roots may be of a persistent character, rapidly multiplying underground. Vacant ground soon becomes occupied by weeds, and may thus become a harbour of pestilential growth to the danger of neighbouring plantations. Weeding becomes less necessary as crops cover the ground, and in the case of rubber or other trees which almost entirely cover the ground it may become nearly dispensable. The growing of intercrops between perennial crops, as Rubber and Coconuts, during the earlier years of their growth has the beneficial effect of economising weeding as well as providing an interim return. Where this is not adopted it is necessary to maintain a clear space of about 6 feet in diameter free of weeds, around each tree.

Those who maintain that clean-weeding is not essential or advisable are supported by the fact that weeds act as a ground-cover, preventing excessive surface wash, while the operation of digging in a crop of weeds ensures tillage and aeration of the soil, and provides useful mulch or green-manure. That weeds in some cases have a redeeming feature is obvious; thus the *Oxalis* (Manickwattie weed) serves to bind the soil on steep slopes, while the Lantana occupies waste and impoverished land which in course of time it enriches considerably with humus.

On estates in Ceylon, the usual system of performing the weeding is to lease out certain areas on contract to the kanganies (headmen of the labour force). The amount paid depends on local conditions and the nature of the crop; thus Rs. 1 to Rs. 2 per acre is about the usual contract price for weeding established Tea fields, but on new clearings the cost of keeping down weeds may vary from Rs. 3 to Rs. 6 per acre. It is estimated that the average cost of weeding Tea in Ceylon ranges from 2 to 3 cents per lb. of made tea.



A USEFUL WEEDING FORK.

An excellent method which may in many cases be applied for killing out or preventing pernicious weeds, is to grow upon the affected area a crop of some annual plant that forms a dense ground-cover, the weeds thus becoming choked out. Any close and quick-growing plant that is obtainable in sufficient quantity will answer the purpose, though it should by preference belong to the Leguminous family, which have the effect of restoring fertility in the soil. (See under *Green Manuring*). The following plants have been more or less successfully used in Ceylon as a ground-cover for checking and destroying weeds: *Passiflora fœtida* (creeper), *Mikania scandens* (creeper), *Ipomœa spp.* (creepers), *Commelina nudiflora*, or " Girapala," S. (creeping annual), *Crotalaria spp*, etc. See *Green-manuring*.

The first principle in destroying weeds is to prevent their seeding, but this is not effective with kinds which are not dependent upon seed for their reproduction, as the Lalang grass (so troublesome in Malay), and the Oxalis in up-country districts in Ceylon, which is reproduced chiefly by small tubers. Therefore recourse must be had to starving out the roots by persistently cutting down the leaves; this also, of course, prevents the plants

from seeding. Persistent cutting down of the leaves and stems has been found effectual in Ceylon in exterminating such pestiferous weeds as the Sensitive Plant and the Tithonia (Mexican Sun-flower), which is so troublesome along the Railway. The same effect may be obtained by placing a layer of mana-grass or other covering over the affected ground. An old maxim which shows the importance of preventing weeds from seeding is that,

One year's seeding,
Is seven years' weeding.

In some cases, as in Coconut cultivation, it is possible to keep down weeds by means of grazing cattle, which also benefit the land by their manure.

Poison weed-killers.—Destroying weeds by means of poisons or weed-killers is not practicable among crops, except perhaps on young clearings. BAMBER recommends arsenate of soda for killing out weeds on young Rubber clearings, when it is impossible to eradicate these by ordinary means. For roads, paths, railway tracts, tennis-courts, compounds, etc., poison weed-killers can, however, be effectually applied. Of commercial weed-killers, there are various kinds, some in powder form, others in liquid. Those consisting of compounds of carbolic or arsenic are the most effective, but other substances, as sulphate of copper, kerosene, common salt, etc., are also sometimes used for the purpose with more or less success. Arsenate of soda has in some cases been found effectual in destroying troublesome weeds, and MR. BAMBER, Government Chemist, has recommended it against "Iluk" (*Imperata arundinacea*) and "Nut-grass" or "Kori grass," (*Cyperus rotundus*), two of the most noxious weed-pests in Ceylon. Where a commercial weed-killer is not available, any of the following simple mixtures may be employed:—(1) Mix 1 oz. carbolic acid with one gallon water, and apply through the rose of an ordinary watering can. (2) Take one part kerosene to three of boiling water, and emulsify with soap. (3) Dissolve one pound common salt in one gallon of boiling water, and apply as hot as possible through the rose of a watering pot, at the rate of one gallon to every two square yards of weedy surface. (4) Take 9 lb. white arsenic and 3 lb. washing soda, boil in one gallon of water till dissolved. For use, add half pint of solution to one gallon of water. In using poisonous weed-killers, gloves should be worn to prevent contact with the skin; care should be taken to keep the solution clear of clothes and boots, whilst going too near grass verges, plant-edgings, etc., must also be avoided.

Water weeds, scum on ponds, etc.—The question of dealing with aquatic weeds frequently confronts one in the tropics, and in some cases involves very large expenditure of money. For submerged weeds, removal by hand or mechanical means is the only effectual way of dealing with them. Certain floating weeds may, however, be destroyed by spraying with a solution of sulphate of copper, say 1 lb. sulphate to a gallon of water. The Bordeaux mixture has been used with good results on weeds of this nature, the solution being sprayed on the surface, if necessary repeated at intervals of a few days or weeks. It has been found that if the solution is not used very strong, it will not injure any fish that may be in the water. A small quantity of copper sulphate placed in a sack, and dragged back and fore on the surface, is sometimes successful in destroying certain water-weeds, but experiments with this method at Peradeniya did not prove effectual for such submerged weeds as *Hydrilla* and *Limnanthemum.*

TABULAR LIST OF THE PRINCIPAL NOXIOUS WEEDS OF CEYLON.

(*Indigenous to Ceylon ; † worst weeds amongst crops. etc.)

Botanical Name.	Common Name (if any).	Locality where chiefly troublesome.
Adiantum cuneatum	Maiden-hair fern.	4,000 to 5,000 ft., among Tea.
†Ageratum conyzoides	Hulantala, *S.* Pumpullu, *T.* Goat-weed.	1,000 to 4,000 feet.
Aloe vera, var. littoralis	Katalai, *T.*	Dry region, sea-coast.
*Amarantus spinosus	Kalu-tampala, *S.*	Semi-dry region.
*Artemisia vulgaris	Wal-kolundu, *S.*	1,000 to 4,000 feet.
*Bidens pilosa.	Wal-te-kola, *S.* Spanish-needle.	Throughout moist region, cultivated ground.
*Blumea membranacea	Annual composite ; 5 to 6 ft. high.	Up to 4,000 feet.
Cardamine hirsuta	Kadavi, *T.*	Up-country generally.
*Cassia mimosoides	Bin-siyambala, *S.*	Low-country.
Chenopodium ambrosioides	(Introduced)	3,000 to 5,000 ft., wet districts
*Cyperus rotundus	Kalanduru, *S* ; Kori, *T.* ; Nut-grass.	Moist low-country up to 2,000 feet.
*Elephantopus scaber	Et-adi, *S.*, Elephant's foot	Low-country, lawns and pasture
†Erigeron linifolius	Alavanga-weed.	2,000 to 6,000 feet.
Eryngium fœtidum	Fit-weed	Peradeniya and Kandy
Galinsoga parviflora	(Introduced)	2,000 to 5,000 ft., cult'd ground.
†Gnaphalium multicaule	Wild-mignonette.	5,000 to 6,000 feet.
*Halopyrum mucronatum	Couch-grass	4,000 to 6,000 feet.
*Hydrilla ovalifolia.	Colombo Lake-weed	Up to 2,000 feet, in ponds, etc.
*Imperata arundinacea	Illuk, Lalang	Moist low-country under 2,000 feet.

S.=Sinhalese; *T.*=Tamil

Botanical Name.	Common Name.	Locality where chiefly troublesome.
Lagascea mollis	(Introduced)	About Kandy, Teldeniya, etc.
Lantana aculeata.	Katu-hinguru, *S.* Lantana-weed.	Low-country up to 3,000 feet.
*Leucas zeylanica	Tumba, *S.*	Low-country, waste-ground.
*Limnanthemum indicum.	Olu, or Maha-ambalu, *S.*	Ponds and streams up to 1,500 feet.
*Loranthus, 6 species. *L.———, 3 ,, *L.———, 7 ,,	Pilali, *S.* Kuruvichai, *T.*	Low-country. Dry region. Montane zone. } Semi-parasites like mistletoe, found on most families of woody plants or trees. Distributed by birds. Only remedy is to lop the affected branches off.
Mikania scandens. (Climber)	Mikania-weed.	Low-country generally.
†Mimosa pudica	Sensitive-plant.	,, ,,
Opuntia Dillenii	Katu-patuk *S*; Prickly Pear; introduced.	Dry region.
*Oxalis corniculatus.	Hin-embul-embiliya, *S.*	2,000 to 5,000 ft., wet region.
†O.—violacea	Manick-wattie weed.	3,000 to 5,000 ft., moist region
*Polygonum punctatum.	Snake-weed.	Hilly districts up to 6,000 ft.
*Portulaca oleracea	Genda-kola, *S.* Pulik-kirai, *T.*	Low-country, cultivated ground.
*Solanum indicum.	Tibbatu, *S.*	Up to 5,000 ft., waste-ground.
Sonchus aspera } S.—oleracea }	Sow-thistle; introduced.	Medium elevations, cult. ground.
Synedrella nodiflora.	(Introduced)	Bentota, Peradeniya, etc.
Tridex procumbens	,,	About Kandy and Peradeniya, 1,600 feet.

SOME NOXIOUS WEEDS IN OTHER WARM OR TROPICAL COUNTRIES.

Botanical Name.	Common Name (if any.)	Name of country.
Carduus arvensis	Californian or "Canadian Thistle."	United States, etc.
Cryptostemma calendulaceum	Cape-weed	New South Wales.
Datura Stramonium	Trumpet Flower	
Eichornea (Pontederia) crassipes	Water Hyacinth	Florida, Queensland, etc.
Erigeron canadense	Cobblers' Pegs	New South Wales.
Nasturtium officinale	Water-cress	New Zealand
Opuntia Dillenii	Prickly Pear	Queensland, Northern India, etc.
Panicum Curtissii	Maiden Cane	Florida, etc.
Phytolacca sp.	Poke-weed	New South Wales, etc.
Polygonum tomentosum	—	Ootacamund, etc.

S.=Sinhalese; *T.*=Tamil

Botanical Name.	Common Name (if any.)	Name of country.
Pteris aquilina	Bracken-fern	New South Wales, etc.
Sida retusa	Paddy's Lucerne	
Sorghum halapense	Sorghum-weed	West Indies, Central India, etc.
Tagetes minuta	Mexican Marigold	South Africa
Vittadenia australis	Australian Daisy	Ootacamund, etc.
Xanthium spinosum	Bathurst-burr	New South Wales, Queensland, etc.
X.—strumarium	Cockle-burr	

CHAPTER XXVIII.

INSECT PESTS

The extent of the destruction to crops by various insect pests in different countries is incalculable. According to a recent return issued by the United States Agricultural Department, the direct and indirect yearly losses caused by insects, in that country alone, amount in the aggregate to the enormous total of over 700,000,000 dollars (£ 140,000,000). The loss to tobacco crops is put down as 5,000,000, to cotton 30,000,000, and to apple crops 20,000,000 dollars. Though Ceylon possesses a large variety of insect life, it has practically no insect-pest of an alarming nature as compared with some other countries. Spasmodic outbreaks are, however, liable to occur here as elsewhere, and it should always be remembered that prevention is better than cure. There are many simple precautions which are sufficiently obvious to anyone who practises agriculture or horticulture intelligently, and the following hints, briefly stated, may afford a guidance, being more or less adaptable according to the nature of the crops or local circumstances. It should not be forgotten that proper rotation of crops, a system of intercrops, green-manuring, good cultivation or the application of certain fertilisers (as kainit, nitrate of soda, etc.), all have a most beneficial effect in the suppression of insect pests. In other words, to maintain a vigorous condition of the plants or crops cultivated is one of the most important safeguards against insect pests or fungus diseases. Thus in reference to shot-hole borer (perhaps the most troublesome pest of Tea in Ceylon), Mr. Green, late Government Entomologist, has stated: "I have repeatedly observed that a vigorous condition of the plant results in a tendency to choke out the insects. The mouth of the tunnel is invaded by an ingrowth from the active cambial tissues. New wood is then formed, covering up the old wound, and the plant is able to carry on all its functions without interruption. The object of the planter, therefore, should be to induce by proper pruning and cultivation such a vigorous condition that the damage is automatically and continuously repaired."

PREVENTIVE OR REMEDIAL MEASURES

Handpicking of insects is recommended wherever practicable, as in the case of borers, large caterpillars, etc.; these may be killed when collected by dropping them into diluted kerosene oil, boiling water, or in a pot of tar.

Light Traps and Smoke.—Lights are useful traps for certain insect pests, especially such as fly at night. *Acetylene Lamps* are thus used with good effect in the vineyards of Europe as a means of catching moths and other injurious insects. The method adopted is to set the lamps out at night (preferably on dark nights) at distances of about 500 yards apart. The insects are attracted in swarms by the flame, and are killed in a weak solution of kerosene which is placed in a shallow basin adjusted a few inches below the burner. In a similar way an ordinary *Kesrosene Lamp* with reflectors, hung over a broad tray containing jaggery and water, or water with a film of kerosene, may be used for catching cockchafers, moths, ants and other insects. *Smoke from Fires* is a deterrent to some insects, and is sometimes recommended for such as attack Rice and other dense crops.

Rolling Pasture-land, net-dragging, etc.—For caterpillar pests in rice fields and such like, it is recommended to draw wooden rollers over the pasture land in the neighbourhood, if practicable. The use of a bag or a net dragged over the ground is advised by the Imperial Entomologist of India, thus :—"A bag can be made to suit all circumstances ; with a width of about 12 ft. and an opening 3 ft. high or less, it may be attached to a frame of bamboos, and a single man draws it between the rows of crops, along grass strips, or in any narrow places. The simplest pattern has only two upright bamboos to hold open the sides ; a better one has four bamboos, the two cross ones with projecting handles, and this pattern closes up automatically at the end of each sweep. In some cases it is desirable to smear the inside of the bag with oil or tar to catch the insects as they fly in."

Entomogenous or Parasitic Fungi.—Locusts or grasshoppers and beetles are reputed to be successfully destroyed by means of a parasitic or entomogenous fungus disease; this is distributed either by spraying spores on the trees or by inoculating live locusts or beetles, which on being let loose spread the disease amongst their fellows with, it is supposed, fatal effect. The actual results, however, under average conditions appear to be a moot point.

Trap-crops, vegetation belts, etc.—A successful way of warding off an attack by insects of an omnivorous nature, is to sow a quick-growing crop intermixed with the main crop; thus the former, furnishing food for the insects, will attract their attention from the latter. Locusts are sometimes destroyed in large masses by planting belts of quick-growing shrubs (such as the Castor-oil plant), which at the season of the locust attack are heavily poisoned by a strong insecticide, such as arsenic compounds.

Insect traps.—Trenches or holes cut in the earth are sometimes found to be successful as traps for caterpillars, which, falling into these at night, are unable to climb out again, and at daylight may be collected and destroyed. Empty jam tins sunk level with the surface soil will form good pitfalls. Also large leaves or pieces of cut vegetation laid on the ground act as useful traps, as many injurious insects will hide under these during part of the day, especially in the early morning, when they should be looked for and destroyed.

Mechanical protection against insect pests.—In spite of all precautionary measures it is often necessary, especially in up-country gardens, to protect young tender seedlings by placing a tin cylinder around each plant until it has outgrown its liability to be attacked by grubs, etc. These tin "collars" may be obtained locally at about Rs. 2 per hundred. Empty jam and condensed-milk tins, or even a roll of stout paper, may also be used for the purpose.

Plants as insect-preventives.—Certain plants have the reputation of possessing properties which are obnoxious to insects, and of having the effect of driving the latter away. Thus tomato leaves are, in some countries, spread around tender plants, and by reason of their strong odour are supposed to afford protection from injurious insects. *Acorus calamus* ("Wada-kaha") and several species of *Alocasia* ("Habarala") are considered to be effective against termites (white ants). Thus Mr. Ridley, late Director of Botanic Gardens, Singapore, states that the roots of the former plant "are pounded to powder, spread around the base of trees attacked by white-ants, when all the latter will die." (See *Straits Agricultural Bulletin* for 1904). Cultivators of market gardens up-country use the chopped-up leaves of the "Wild Lobelia" or "Kiri-bamboo" (*Lobelia nicotianifolia*) as a protection from the destructive black-grub, while in the low-country tobacco leaves are considered by some to have a deterrent effect on certain insects.

Palm Beetles.—The crown or "cabbage" of coconut and other palms often become attacked by large beetles, more especially the "black beetle," which disfigure the fronds and sometimes permanently injure the tree. These beetles may be harpooned or extracted by a stiff piece of sharp wire (or a long hat-pin) with a barb at the end, the hole being then filled with very fine dry sand. The latter is itself a remedy as well as a preventive, and may be copiously applied to the cavities at the junction of the leaves; it will prevent fresh attacks by more beetles, while it disables any that may already be in their crevices by getting into the joints of their bodies. Red beetles are the most serious, as they attack in enormous numbers, and breed rapidly inside their host; so that if a tree becomes infested with this pest, it must at once be cut down and destroyed.

Eelworms & Nematodes.—A microscopic group of translucent animals which often cause considerable injury, or even death, to plants before their presence is detected. They live in the soil, first attacking the roots and rootlets, which in time become knotty, bearing small wart-like excrescences. Plants that are badly affected should be removed and destroyed by fire ; the soil should be opened up and treated with vaporite or a dilute disinfectant; liming the soil, change of plants or rotation of crops are also measures to be advised for the elimination of the pest.

Wireworms,—the larvæ of various kinds of beetles, seldom reaching 1 in. in length. They are often a troublesome pest, gnawing the stems and roots of plants just below the surface. An application of vaporite is one of the best remedies.

Mosquito preventives.—The conditions which favour the breeding of the larvæ of mosquitoes—which are the recognised medium of conveying malaria to human beings—are stagnant water, as is frequently found in drains, roof-gutterings, discarded tins, broken vessels, bamboo stumps, etc., also damp shade, as under heavy foliage. Plants with water-collecting adaptations, as sheathing leaves or floral receptacles, likewise offer similar facilities for the pest. In addition to guarding against these sources as far as possible, free use should be made of dilute disinfectants, especially such as leave a film on the surface of the water, as kerosene oil, Jeye's, Cyllin, Phenyl, and Izal disinfectants.

USEFUL INSECTICIDES.

Insecticides act in two ways, viz. as a *Stomach Poison*, when taken internally by the insect with its food; or as a *Contact*

Poison, as in the case of insects which obtain their food by sucking, as bugs in general. Some contact poisons also kill by *Asphyxiation*, i.e., by forming a coating around the insects, thus preventing their breathing; scale insects are affected chiefly in this way. Generally speaking, the remedies for aphis (green-fly, etc.) are in the nature of a contact poison, as emulsions, tobacco-juice, etc., while for beetles, caterpillars and grasshoppers, stomach poison, such as "Paris Green," "London Purple," etc., are more effectual. Insecticides in liquid form (with water) may be applied by a fluid sprayer or a syringe capable of emitting a fine spray or mist, distributing the liquid evenly over the whole plant; while those in the form of powder, mixed with lime, dust, flour, etc., may be dusted from a powder-sprayer or bellows.

Arsenate of Lead. (Sugar-of-lead).—This compound is considered to have special advantages over "Paris green;" it is much lighter than the latter, does not scorch the foliage, and can therefore be used more freely. Satisfactory results have been obtained by using from 1 to 2 lb. of arsenate of lead to 150 gallons of water. The following formula is recommended :—Acetate of lead $2\frac{3}{4}$ oz., arsenate of soda 1 oz., water to make up to 10 gallons. Place the materials in the water and stir till dissolved, when it is ready for use. One pound of treacle may be added to render the mixture adhesive.

Arsenate of Lime.—As a substitute for the above the following may be used:—1 lb. arsenic, 4 lb. washing soda, and 2 gallons water. Boil till dissolved. Make up to 4 gallons with water. Add one pint of the mixture to 4 gallons of water, and add to this 4 oz. unslaked lime.

Borer Wash.—1 pint crude carbolic or phenol; 2 lb. soft soap or hard soap $2\frac{1}{2}$ lb.); 1 gallon hot water. Dissolve the soap in hot water, and add enough clay to thicken it.

Carbon Bisulphide.—A highly volatile and inflammable clear liquid, the vapour of which is given off at a low temperature and is fatal to insect life. It is used successfully in the destruction of ground-insect pests, where these are numerous or in colonies, as in the case of termites. The poison is best applied to termites' nests by saturating bolls of cotton wool with it, and dropping one of these in each burrow, the latter being then quickly closed up. The vapour, being heavier than air, sinks to the bottom of the crevices and permeates the whole "nest."

Caustic Soda.—A white solid substance, very soluble in water, acts as a caustic, is powerfully alkaline, and is deliquescent on

exposure to the air. In temperate countries it is generally used in conjunction with potash as a spray fluid on dormant trees and bushes, when, in addition to cleansing the trees, it proves destructive to many forms of insect life. The solution is made as follows:—Caustic soda, 1 lb.; soft soap, ½ lb.; carbonate of potash, 1 lb; water, 10 gallons. Dissolve the soft soap in hot water, and add to cask or vessel containing 10 gallons of water in which the soda and potash have been dissolved.

Emulsions.—Kerosene, paraffin, petroleum, etc., in the form of emulsion afford one of the most effective insecticides known for sucking-insects. Many formulas have been devised, but the following will serve all practical purposes:—Kerosene (paraffin or petroleum), 1 gallon; soft soap, 1 lb.; boiling water, 1 gallon. Dissolve soap in boiling water, and add, boiling hot, to the kerosene. Churn the mixture thoroughly until a cream-like emulsion is formed. This should thicken to a jelly on cooling, and adhere without oiliness to the surface of glass. The hotter the mixture, the easier the emulsion is formed. For use, add 1 part emulsion to 10 parts water. No form of emulsion should be applied to foliage during sunshine.

Gondal-fluid.—4 oz. gum, 8 oz. asafœtida, 8 oz. bazaar aloes, 3 oz. castor-cake. Mix well with water, add clay to thicken, and paint on the base of trees which are liable to be attacked by white-ants or other insects. Gondal fluid is an Indian preparation and has been specially recommended by Sir George Watt for applying to Tea bushes as a preventive against white-ants.

Hot water as an insecticide.—Up to a temperature of 170 or 200 degrees (Fah.) of heat, hot water will destroy many destructive insects without injuring their host plants. Even boiling water applied by a syringe will usually cool sufficiently between the syringe and plant to avoid injury to the latter, while it is still hot enough to kill the insects.

London Purple.—A fine powder arsenical preparation, of similar use to "Paris Green," but generally considered to be less safe than the latter. It is a by-product obtained in the manufacture of aniline dyes.

Paris Green.—Also known as "Emerald Green," "Mitis Green," and "French Green." A powerful irritant and poisonous compound of arsenic, copper and sulphuric acid, which has the appearance of fine powder with a clear green colour. For use take one ounce of the powder and mix in 12 gallons of water. Like

other arsenite compounds, it should be applied in the form of a fine spray, the liquid being meantime kept constantly stirred, and regulated in strength according to the nature of the plants sprayed.

Quassia, or Bitterwood.—A vegetable insecticide, consisting of the bitter principle of the tree *Picræna excelsa*, which is fatal to may forms of sucking-insects, particularly aphides. For use take 1 lb. quassia chips, 1 lb. soft-soap, 10 gallons water. Boil the quassia with half the soap and half the water for one hour, strain off the liquid and boil the residue for another hour with the remaining soap and water. Mix the whole together, and make up to 10 gallons with water. Never spray trees or plants bearing edible fruit or leaves with quassia, as it imparts a bitter taste not easily got rid of. According to the *Jamaica Bulletin*, nothing has been so successful in driving black-ants away as Bitterwood solution.

Resin or Rosin.—This enters into the composition of several valuable spray-fluids which destroy different forms of scale-insects, being especially suited to deciduous trees. It acts by depositing a covering over the insect, thus killing the latter by preventing its breathing. The following formula is recommended :—Resin, 4 lb.; fresh oil (seal or train oil), 2 pints; caustic soda, 1½ lb.; water, 10 gallons. Boil the first 3 ingredients mixed with the water until the resin is dissolved, then make up to 15 gallons of water. Before using the solution it should be diluted with nine times its quantity of clear water. This solution is recommended in America for use against the "sooty-mould" on Orange and other Citrus trees.

Tobacco juice.—An efficacious insecticide (also a fungicide) for aphides, used largely in Europe, America, etc., more particularly in plant-houses. The juice when of the standard strength is diluted with 100 parts of water for spraying purposes. The plants should be sprayed after sunset, and syringed with clear water on the following morning. The juice may be prepared by soaking ½ lb. common tobacco leaf to a gallon of hot water.

Tobacco-smoke is chiefly used for fumigating plants in glass-houses, being a powerful insecticide for certain insects. It is obtained by burning tobacco, or paper steeped in tobacco juice. More effective, however, than tobacco-smoke, and less harmful to tender plants, is the vapour caused by the heating of the newer Nicotine Vaporisers, such as the "XL. All Vaporiser" and

others, which are probably compounds of nicotine obtained from tobacco and alcohol. These are proprietary remedies, and directions for their use are issued by the manufacturers.

Vaporite.—A grey powdered preparation, called "vaporite," made by the Vaporite Co. in London. It is one of the most efficacious of insecticides that are adapted for applying to the ground, giving off when mixed with the moist soil an insect-killing vapour. It destroys grubs, eelworms, millepedes, cockchafers, etc. in the soil, without apparently injuring the roots, and may be applied by mixing with the surface soil, or by inserting in holes several inches apart made with a crowbar. For pot-plants it should be applied in a weak solution with water. Vaporite may be obtained locally from MESSRS. E. B. CREASY & Co., Colombo, and every one who grows plants, either for use or ornament, should have some always at hand.

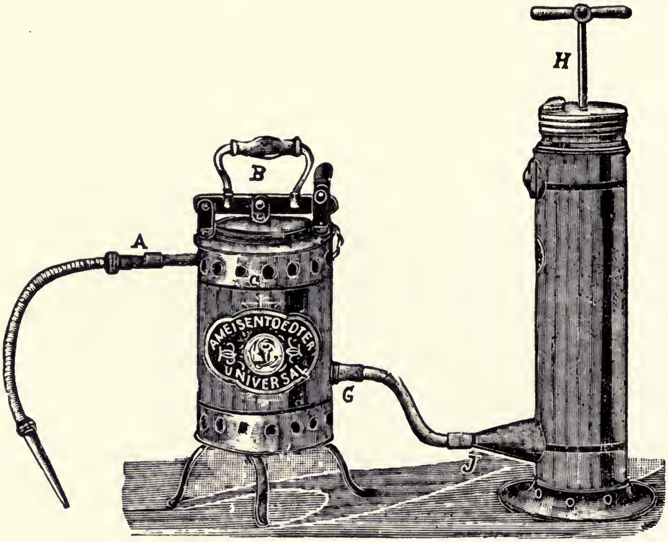
Quicklime.—Fresh-slaked pure lime, especially coral lime, is of great value as an insecticide when dusted over the ground or mixed in with the soil. It also serves as a useful diluent of poisonous powders, being used to a large extent in the preparation of some of the more active insecticides and fungicides to avert their caustic action on foliage. When quick-lime is applied in the form of a wash or spray, it leaves a coating over the part so treated, and thus prevents fungi from obtaining a footing on the leaves, etc.

MEANS FOR DESTROYING TERMITES OR WHITE-ANTS.

The "Ant-Exterminator."—Of the various devices as yet adopted for destroying termites, this is probably the best. It consists of a small charcoal furnace in connection with an air-pump. Some glowing charcoal is placed in the furnace ; a spoonful of the mixture (composed of white arsenic 85% and sulphur 15%) is thrown on the charcoal and the lid firmly clamped into position. A flexible nozzle (A in the figure) is pushed into the main entrance of the nest, and all supplementary holes are plugged with clay. The pump (H) is then worked, and drives the vapour into the nest, forcing it into all the ramifications of the galleries. Little jets of smoke will soon arise from crevices and unsuspected openings for several yards round the main entrance. These should be immediately stopped with clay or pounded earth. After a few minutes of pumping, the nozzle may be withdrawn and the hole plugged with clay. The nest should remain undisturbed for a week, when the

mound may be levelled. If opened immediately after the application some of the insects will revive. In some few cases there may be feeble signs of renewed activity, in which case a second application will complete the work of destruction; but this is seldom necessary.

Exploding Termites' nests.—The Government Entomologist in New South Wales recommends as follows:—"Pour a little bisulphide of carbon down each hole, and throw a wet bag over the nest immediately afterwards. Remove it in a couple of minutes, and apply a lighted stick over each opening. The fumes

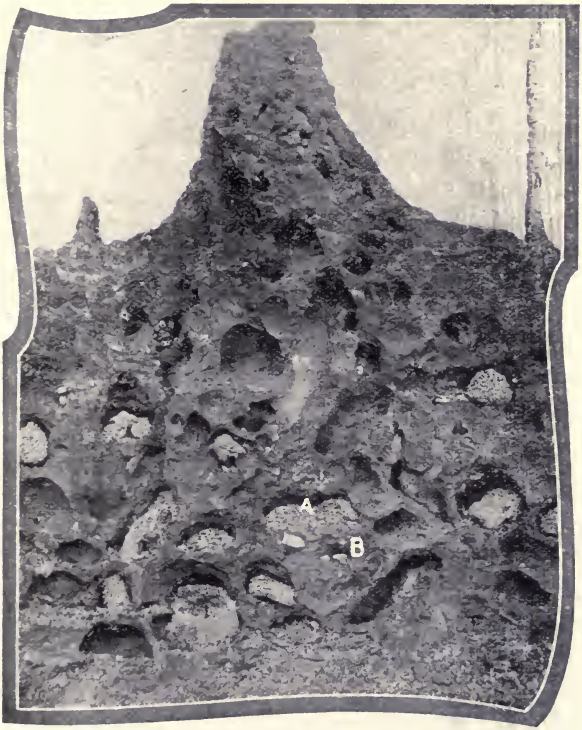


THE "UNIVERSAL ANT EXTERMINATOR." See page 619.

will explode, wreck the nest, and burn all the ants beneath. The lighted stick should be 5 or 6 feet long to enable the operator to stand out of danger."

Poisonous baits for ants.—Destroying termites and other ants by laying down poisonous baits has often been recommended. A mixture of arsenic, sugar, flour, tallow, etc., made into a paste and strewn about in small pellets where the ants are troublesome is found to have a good effect in destroying these. Where it is dangerous to use arsenic, a syrup of borax may answer the purpose to some extent. A stiff dough made of "Paris Green," (1 oz.), flour (3 lb.), and sugar (3 oz.), being formed into pellets and placed in holes near the plants attacked, has been found effective.

Preventives against white-ants, etc.—It is always advisable when sowing seed, planting out or transplanting plants in a locality which is subject to white-ants, to fork in with the soil a mixture which will act as a preventive against this destructive pest. Lime and sulphur, or lime alone, are recommended for the purpose, while vaporite or carbolic disinfectant-powder are found efficacious at Peradeniya. Watering the ground with a disinfectant solution



SECTION OF TERMITES OR WHITE ANTS NEST.
A.—"Royal" cell; B.—Queen Ant.

also acts as an excellent preventive, which is often adopted at Peradeniya in the case of rose-beds and flower borders. The smell of tar is obnoxious to insect life of all kinds, and water impregnated with tar may sometimes be applied to the ground with good effect. For painting on the base of trees as a preventive against termites, diluted tar and "Gondal Fluid" (see *Insecticides*) are used with good results.

Black-ants.—These are sometimes very troublesome in a garden, undermining roads, lawns, etc. According to the "*Jamaica Bulletin*" nothing has been so successful in expelling these as a solution of bitterwood (See quassia under *Insecticides*).

FUMIGATING

Destroying insect-pests by means of fumes of poisonous gas, tobacco smoke, etc., is commonly adopted wherever plants are grown in closed structures, and also in the fields where fruit-growing is practised on systematic lines. For cheapness, efficiency and facility of application, the hydrocyanic gas process of fumigating has been found to be the most satisfactory yet discovered. It is extensively practised in America for orchards as well as for general nursery stock, more especially against scale-insects, which are difficult to destroy by other means. The gas is a deadly poison, and the greatest care is needed in using it. It is generated from cyanide of potassium (or sometimes sodium cyanide) and sulphuric acid, and is fatal to insect or animal life by inhalation. When applied to trees or shrubs in the open, special collapsible tents are used for the purpose of enclosing these. Small or movable plants may be treated in any enclosure, provided it is sufficiently air-tight. An ordinary wardian case with a capacity of about 7½ cubic feet is used for the purpose at Peradeniya, the proportions recommended being: ¼ oz. cyanide of potassium (90%), ¼ oz. sulphuric acid, and ½ oz. water. Place the water in a small earthenware bowl; add the acid; drop in the cyanide, and close the case immediately, stopping up all crevices with wet clay to prevent the gas escaping. After the expiration of half an hour, open the case and leave it for several hours. The principle is the same when the process is applied on a larger scale. When fumigating plant-houses, the cyanide is usually wrapped in a small suspended paper bag, which is dropped into the acid and water by means of a string passing through a trap-door and released from outside. The proper amount of cyanide to be used varies according to the nature of the pest and plants to be treated, but the proportions, as above stated, should always be approximately the same. Experienced men recommend four-fifths of a grain of cyanide for every cubic foot of free space. It is considered by some that the water should be boiling when the acid is added (the cyanide being then dropped into it), but this does not appear to be necessary. An essential condition in any method of fumigating is that, contrary to

spraying, the foliage be dry; otherwise the plants are very liable to be injured. The latter should not be watered immediately before fumigation, neither should they be exposed to the sun for several hours after treatment. Fumigation should always be carried out only after sunset, unless the plants are in the shade under cover.

Spraying.—See *Fungus Diseases of Plants.*

TABULAR LIST OF COMMON INSECT PESTS OF CEYLON.

Arranged According to the Crops or Plants Attacked.

ESTATE PRODUCTS:—

*Only brief and provisional remedies can be given here; these are omitted where more complicated treatment is required.

Host Plant.	Name of Insect.	Parts attacked.	*Brief remedies or preventive measures.
Albizzia	Case-or Cadis-worms (*Psyche spp*).	Leaves	—
	Caterpillar (*Terias sylhetana*).	,,	—
Annatto	"Mosquito Blight" (Bug) (*Helopeltis antonii*).	Young shoots	Emulsion spray.
Cacao	Borer (*Arbela quadrinotata*).	Stem	Plug holes in bark with tar
	Bug (*Helopeltis antonii*).	Fruit and young foliage	Emulsion spray.
	Pot-borer (*Dichocrocis punctiferalis*)		Collect and destroy affected fruits.
	White stem-borer (*Monohamus fistulator*).	Stem	Cut out and destroy attacked parts, and apply tar.
Camphor	Caterpillar (*Papilio clytia*).	Leaves	Spray with lead arsenate.
	Shot-hole Borer (*Scolytid sp*).	Stem and branches	Cut and destroy affected parts.
Cardamom	Bug (*Ischnodemus noctulus*).	Foliage	Emulsion spray.
	Pod-borer (*Lampides elpis*).	Fruit	
	Root-borer (*Hilarographia caminodes*).	Rhizomes	Apply Vaporite to soil.
	Stem-borer (*Dichocrocis evaxalis*).	Stem	Cut and destroy affected stems.
Castilloa-rubber	Mealy-bug (*Dactylopius crotonis*).	Young branches	Emulsion spray.
Castor-oil Plant	Bug (*Aleurodes sp.*)	Foliage	Emulsion spray.
	Caterpillar (*Arctia ricini*).	,,	Lead arsenate.
Cinnamon	Gall-mite (*Eriophyses boisi*)	,,	Sulphur spray.
Citronella Grass	Scale-bug (*Chionaspis graminis*).	,,	Emulsion spray.

Host Plant.	Name of Insect.	Parts attacked.	*Brief remedies or preventive measures.
Coconut Palm	Red-weevil (*Rhynchophorus signaticollis*).	Stem and crown	Collect and destroy, or harpoon with pointed wire.
	Black-beetle (*Oryctes rhinocerus*).	Tender part of crown	(See Palm-beetles).
	Black-headed caterpillar (*Nephantis serinopa*).	Foliage	Cut and burn infested fronds.
Coffee, Arabian and other kinds.	Green-bug (*Lecanium viride*).	Foliage	Emulsion spray
	Brown coffee-bug (*Lecanium hemisphæricum*).	,,	,,
	Coffee-borer (*Zeuzera coffeæ*).	Stem and branches	Cut out and destroy infested parts.
	Cockchafer-grubs, (various species).	Roots	Vaporite
Cotton	Black-bug (*Lecanium nigrum*).	Branches	Emulsion spray
	Cotton Stainers (*Disdercus cingulatus, Serinetha augur, Oxycaraenus lugubris*).	Lint	Spread lint in sun
	Pink Boll-worm (*Gelechia gossypiella*).	Pods	Destroy infested bolls
	Mealy-bug (*Doclylopius virgatus*).	Foliage and young branches	Emulsion spray
Croton-oil Plant	Defoliator (*Amyna selenampha*).	Foliage	Lead arsenate
Ground-nut	Pod-borer (*Dorylus orientalis*).	Fruit	Vaporite
	Leaf-miner (*Anacampis nertaria*).	Foliage	Emulsion spray
Hevea	See Para Rubber	—	—
Lagos-rubber (*Funtumia*)	Leaf-roller (*Caprinia conchylalis*).	Foliage	Lead arsenate
Mahogany	Caterpillar (*Attacus atlas*).	,,	,,
Mulberry	Scale-bug (*Aspidiotus aurantii*).	Branches	Emulsion spray
Nutmeg	Flat-bug (*Lecanium expansum*).	Foliage	,,
Para Rubber	Cockchafer-grub (*Lepidiota pinguis*).	Roots	Vaporite
	Black-bug *Lecanium nigrum*).	Foliage and young branches	Emulsion spray
Pepper	Scale-bug (*Lecanium marsupiale*).	Foliage	,,
	,, (*L. Peradeniyense*).	,,	,,
Rhea or Ramie	Leaf-roller (*Sylepta sabinusalis*).	,,	Lead arsenate

Host Plant.	Name of Insect.	Parts attacked.	*Brief remedies or preventive measures.
Rice (Paddy)	Arrakkodian worm (*Spodopteror maurittia*).	Foliage	Burn grass, etc., in vicinity; smoke drives insects away
	Paddy-bug, or rice Sapper (*Leptocorisa acuta*).	Flower	Catch by hand, or trap by screens smeared with gum
	Paddy-weevil (*Calandra oryzae*).	Grain	Napthalin
Tea	Shot hole-borer (*Xyleborus fornicatus*).	Branches	Cut out and destroy affected stems ; burn prunings on fields
	White-ant or Termite (*Calotermes militaris*).	Live or dead stems.	See under *Insecticides*
	Tea-bug or "Mosquito Blight" (*Helopeltis antonii*).	Foliage	—
	Tea-mites (various spp).	,,	Dust with sulphur
	Nettle-grubs (*Limacodidae spp*).	,,	Hand-pick
	Case-worms (*Psychidae spp*).	,,	,,
	Tea-tortrix (*Capua coffearia*).	,,	Collect and destroy eg masses
	Lobster Caterpillar (*Stauropus alternus*).	,,	Hand-pick
	Thrips (*Physopus rubrocinata*).	,,	Sulphur spray
Teak	Leaf-eater (*Hyblœa puera*).	,,	Lead arsenate spray
Tobacco	Stem-borer (*Gnorimoschema heliopa*).	Stem base	Cut out grub; destroy badly attacked plants

FRUITS :—

Host Plant.	Name of Insect.	Parts attacked	*Brief remedies or preventive measures.
Cherimoya, Custard-apple and other spp. of *Anonaceae*	Black scale-bug (*Lecanium nigrum*)	Branches	Emulsion spray.
Jambu, Rose-apple, etc.	Gall-fly (*Psylla sp*).	Foliage	—
Mango.	Fruit-fly (*Dacus ferrugineus*).	Fruit	Collect and destroy infested fruits.
	Mango-weevil (*Cryptorhynchus mangiferae*).	,,	
	Scale-bug (*Lecanium mangiferae*).	Foliage	Emulsion spray.
Orange, Limes, Lemons, etc.	Scale, or Sooty-mould bug (*Lecanium viride*) (*Mytilaspis citricola, and Pulvinaria psidii*).	Foliage	Emulsion spray.

VEGETABLES :—

Host Plant.	Name of Insect.	Parts attacked.	*Brief remedies or preventive measures.
Tomatoes	Gall-worm (*Heltrodere radicicola*).	Root	Vaporite, which see.
Bandakka (*Hibiscus esculentus*)	Leaf-roller (*Sylepta multilinealis*).	Foliage	Lead arsenate.
Beans (*Phaseolus*)	Fly-maggot (*Agromyza phaseoli*).	Stem and foliage	Sprinkle vaporite on ground about the plants.
	Sucking-bugs (*Coptosoma cribarium* and *Reptortus fuscus*).	Foliage	Hand-pick.
Brinjal (*Solanum*)	Stem-borer (*Leucinodes orbonalis*).	Young shoots	Cut off, and destroy infested shoots.
	Sucking-bug (*Urentius echinus*).	,,	Syringe with emulsion
Cabbages (*Brassica* family)	Caterpillar (*Plutella maculipennis*).	Foliage	Hand-pick.
	,, (*Crocedolomia binotalis*).	,,	Hand-pick.
	Black-grub (*Agrotis segetis*)	,,	Hand-pick; sprinkle vaporite about the plants.
Gourds, Pumpkins, etc.	Sucking-bug (*Leptoglossus membranaceus*)	,,	Vaporite or lead arsenate.
	Leaf-beetle (Several species of *Chrysomelidae*).	,,	Arsenic spray.
	Fruit-fly (*Dacus ferrugineus*).	Fruit	Hand-pick. Collect and destroy infested fruits.
Potato	Bulb-borer (*Dorylus orientalis*).	Tuber	Vaporite.

ORNAMENTAL PLANTS :—

Host Plant.	Name of Insect.	Parts attacked.	*Brief remedies or preventive measures.
Amaryllis	Caterpillar (*Polytela gloriosae*).	Foliage	Lead arsenate.
Bamboos	Scale-bug (*Asterolecanium bambusae*).	Stem	Syringe with emulsion.
	Aphis (*Oregma bambusae*)	Stem	,,
Cycas	Caterpillar (*Cyaniris puspa*).	Foliage	Lead arsenate.
	,, (*Catachrysops pandava*).	Young foliage	Lead arsenate.
Dahlia	Bulb-borer (*Dorylus orientalis*).	Tuber	Vaporite.
Ferns	Flea-beetle (*Hypnophylla flavipennis*).	Foliage	Lead arsenate.
	Scale-bug (*Lecanium hemisphaericum*).	Foliage	Syringe with vermisap (1 lb. to 40 gal. water) or other emulsion.

Host Plants	Name of Insect.	Parts attacked	*Brief remedies or preventive measures.
Hibiscus	Leaf-roller (*Sylepta multilinealis*).	Foliage	Lead arsenate. Destroy infested flower buds.
	Flower-beetle (*Mylabris pustularis*).	Flower	
Ipomoea, different spp.	Hairy-caterpillar (*Euchromia polymena*)	Foliage	
Jasminum pubescens	Bud-borer (*Hendecasis duplifascialis*)	Flower buds	
Palm in pots	Fringed-bug (*Cerataphis lantaniae*).	Foliage	Syringe with emulsion.
	Caterpillar (*Elymnias fraterna*).	,,	Hand-pick, or lead arsenate.
	Scale-bug (*Lecanium hemisphaericum*).	,,	Syringe with an emulsion. The old brown scales are dead, but remain adhered to the surface and shelter numerous eggs underneath.
Pergularia (Perennial climber)	Scale-bug (*Lecanium caudatum*).	,,	
Portlandia (Shrub)	Caterpillar (*Caprinia conchylalis*).	,,	"Paris Green," or arsenate.
Roses	Scale-bug (*Aspidiotus aurantii*).	Stem and foliage	Syringe with emulsion.
	,, (*Icerya aegyptiaca*).	,,	
	Rose-beetle, several species.	Fl's and young foliage	Hand-pick. Sprinkle vaporite about bushes.
Salvia, Thunbergia and other *Acanthaceae* plants.	Lantana-bug (*Orthezia insignis*).	Foliage and stems.	Emulsion spray.

CHAPTER XXIX.

FUNGUS AND OTHER DISEASES OF PLANTS

Fungi differ from plants possessing green leaves in not being able to obtain their food from the soil; they can only derive nourishment from the bodies of plants or animals, either living or dead. Those fungi that live on dead vegetable matter, as humus, decaying wood, roots, etc., are called *saprophytes;* these do not injure living plants, unless they alter their mode of obtaining nutrition, as they sometimes do, and become parasitic. Fungi which grow on living plants are known as *parasites;* the greater number of these are very minute, and are only visible to the naked eye when present in great numbers. All parasites cause disease, important or not, according to the extent to which they occur and the harm they do to plants or crops.

Preventing the spread of diseases.—The methods available for combating diseases are more or less regulated by the life history of the fungi concerned, and may be grouped under the following heads: (1) by destroying the plant tissues that contain the vegetative forms or the reproductive spores of the fungus; (2) by spraying with a fungicide to prevent the germination of spores deposited on leaves, stems, or fruits; (3) by avoiding conditions that are known to be favourable to the spread of the disease; (4) by raising disease-resistant varieties; (5) by prohibiting the importation or transport of plants or seeds from diseased-infected countries or localities.

Destroying plant tissues.—The most certain means of eradicating a disease is to burn the affected plants, or cut and burn the diseased portions of these. When the latter course is adopted, the cut surfaces of the living plant should always be painted with tar or other substance that will prevent the germination of fresh spores which may fall on them. When burning is not practicable, as through excessive moisture, the diseased parts should be buried with lime. Lime not only hastens decay, but also prevents local souring of the soil by the addition of large quantities of decaying

matter, and thereby discourage conditions which predispose plants to disease. Thus the burial with lime of all diseased cacao pods, as well as the husks of healthy pods, left after the beans have been extracted, has been found to have an important effect in preventing the spread of the pod-disease of Cacao.

Conditions favourable to infection.—In damp, warm weather and in shady situations, spores of fungi stand the best chance of germination. Conditions of the soil which are unfavourable to plants, as defective drainage, etc., are sometimes conducive to the rapid spread of a root disease. Crowding together plants of the same kind also favours the spread of disease, or an epidemic or extensive wave of disease can only occur where large numbers of the same kind of plant are growing in close proximity, as in the exclusive cultivation of single crops.

Wounds a cause of disease.—A large number of fungi can bring about infection of their host-plants only through wounds or breaks in the bark. Canker is generally formed by a wound parasite, and in order to avoid conditions likely to bring about infection by it, careful attention should be given to the operations of pruning, fruit-picking, etc., as well as the tarring of all wounds.

Isolation of affected areas.—The spread of a root disease may sometimes be effectually arrested by means of cutting a trench round the affected area, the progress of the mycelium through the soil being thus confined to certain limits. This prevents healthy plants being attacked, and enables the affected areas to be cleared and treated with large quantities of lime.

Effects of rotation of crops.—A fungus disease may often be starved out by rotation of crops. This, however, is only possible in the case of annual or temporary crops, like root products, etc. In the case of permanent crops, as Cacao, Tea, Rubber, etc., when a tree has died from a root disease, the diseased roots should be carefully extracted from the ground and destroyed, the soil being opened up and treated with lime, the cavity being allowed to remain open for some time before the vacancy is supplied.

Disease-resisting varieties.—Some varieties or species of plants are more or less immune from disease, while others, cultivated under the same conditions, are specially susceptible to it. Therefore varieties which are the least susceptible, consistent with other desirable qualities, should be selected for cultivation. The raising or selection of disease-resisting varieties is now recognised

as a matter of considerable importance in horticulture and agriculture.

Good cultivation a preventive of disease.—The remarks applied in the case of insect pests with regard to the importance of maintaining a vigorous condition of the plants or crops grown, are equally applicable in the case of fungus diseases, for plants in vigorous growth are often capable of combating the parasitic effects of a disease, while those of a weaker constitution succumb to it. Therefore, good cultivation, as secured by proper draining, manuring, careful pruning, etc., should be considered an effective measure towards the suppression of a fungus disease.

Importation of plants from infected areas.—This has often resulted in the introduction of new diseases, and many countries have now formulated laws to prevent such an occurrence. The importation or transference of seeds or plants from countries or localities affected with fungus diseases should, therefore, be allowed only where quarantine measures for disinfection are adopted.

USEFUL FUNGICIDES

Bordeaux Mixture.—This is one of the most useful and effective fungicides for application to plants attacked with mildew or other fungus disease. There are various formulas for making it, all of somewhat varying degrees of strength. The following proportions represent a standard formula and may be recommended for general use in the tropics : Copper sulphate (98 per cent.) 5 lb. ; lime (freshly burnt) 5 lb. ; add water to make up to 50 gallons. Dissolve the copper sulphate in a small quantity of water, using a wooden tub for the purpose, slake the lime to a paste, mix it with the remaining water and pour into the copper solution. Treacle is sometimes added to render the mixture more adhesive. When being applied, the mixture should be kept thoroughly stirred.

Sulphur.—This is used for the destruction of mildews, whose mycelium is superficial and forms a whitish down on the surface of living leaves, fruit, etc. It is applied as a powder in the familiar form known as "flowers of sulphur," preferably when the affected leaves are damp. Various appliances are in use for blowing the powder on to the leaves, such as sulphur-sprayer, sulphur-bellows, etc. Quicklime is sometimes added to the sulphur, but it should not exceed one third of the whole.

Occasionally sulphur is mixed with water, the solution being applied by a syringe. In glass-houses, sulphur-paste is sometimes painted on the hot water pipes to create sulphurous fumes.

Ammoniacal copper fungicide.—This is a useful fungicide, which has properties similar to those of Bordeaux mixture. It is prepared as follows:—

Copper sulphate (98 per cent) 1½ oz.	Ammonia solution (strongest) 12 fl. oz.
Carbonate of soda (98 per cent.) 1¾ oz.	Water to make 12 gallons

Dissolve the copper sulphate and soda separately, each in half a gallon of water, pour the soda into the copper solution and stir well. When the precipitate has settled, pour off the clear liquid; give the precipitate a second washing, and when again settled pour off the supernatant clear liquid. Then introduce sufficient liquid ammonia to the precipitated copper carbonate to dissolve it, care being taken not to use any unnecessary excess of ammonia. To this add water to make up to 10 gallons, when the liquid is ready for use. This preparation is specially recommended for surface moulds and for the Rose mildew.

Potassium sulphide.—This powerful and useful fungicide must be kept in well-corked bottles or air-tight vessels, as it rapidly decomposes when exposed to the air. Care must be taken to adjust the strength of the solution to the nature and hardiness of the plants under treatment; a quarter of an ounce to one gallon of water will generally answer for slight attacks, and from 4 oz. to 6 oz. in 10 gallons of water is considered strong enough to suit all requirements.

Potassium permanganate. (Permanganate of potash).—A simple but effectual fungicide may be prepared by dissolving about 30 to 40 grains of permanganate of potash in a gallon of water. The solution resembles Condy's fluid, being of a pale claret colour, and may be used for herbaceous and bulbous plants with good effect.

Condy's Fluid, Jeye's Fluid, etc.—These are useful fungicides, and are sometimes employed for sterilising soil, the latter being allowed to remain a week after treatment before anything is planted or sown. The proportions should be about 1 oz. of the fluid to 1 gallon of water.

Corrosive sublimate.—For disinfecting seed, preserving books, dried specimens of plants, etc., nothing is better than a solution of corrosive sublimate. This is a powerful poison and kills bacteria, fungus spores and similar organisms by contact.

It may be used in a water solution, at a strength of about 1 oz. to 6 gallons of water. For books, specimens, etc., the following proportions are recommended: corrosive sublimate ½ oz., carbolic acid ½ oz., methylated spirits 1 pint; apply with a soft brush.

SOME COMMON DISEASES OF PLANTS

Club-root or Slime Fungus.—This disastrous fungus disease attacks the roots of all plants of the Cabbage family (see under Cabbage), and does a great deal of damage in up-country gardens, rendering them in many cases unprofitable for cultivation; it produces large nodules on the roots and, the leaves becoming yellowish, the plants suddenly die. The disease spreads readily by means of spores carried on implements or with plants transferred from an infected area, and once established it is impossible to eradicate it, except by giving up the cultivation of Cruciferous plants for two or three years. Fresh unslaked lime, applied at the rate of 75 bushels to the acre, or about 15 lb. to 100 sq. feet, will, however, check the disease considerably for a time. Rotation of crops also minimises its effects.

Sooty Mould.—Orange trees and other members of the Citrus family are peculiarly liable to this fungus disease, which forms a black crust on the foliage, sometimes covering the entire leaf, and occasionally blackening the fruits also. It is, however, a superficial growth and does not penetrate the tissues of the plant. Its presence is due to scale-insects (species of *Lecanium*), which must be got rid off in order to effectually dispose of the mould. Spraying with petroleum emulsion or a resin wash, followed by syringing with clean water, is the best remedy. The scale-bug (*Lecanium hemisphæricum*) is a very common pest on ferns and other pot-plants, while *Lecanium viride* or green-bug is often troublesome on oranges, coffee plants, etc.

Gumming, or Gummosis.—This condition, which sometimes occurs on fruit trees, especially on Oranges and other Citrus trees, is usually induced by badly drained soils or external injury, as through improper pruning. Experts are not, however, agreed upon the actual cause of the disease, which has been attributed to fungi or bacteria: but it is a common result of injury to the cambium. The best way of preventing its occurrence consists in affording the trees proper cultivation, and preventing as far as possible any rupture of the bark. A remedy that sometimes proves

effectual is cutting out the affected part, and tarring the area or covering it with cow-dung and clay. An application of Bordeaux-paste (2 lb. copper sulphate, 2 lb. unslaked lime in ½ gallon water), applied by a brush, is also recommended.

Damping-off disease.—The common malady known as "damping-off" is due to a fungus (*Pythium*), which affects young and small tender plants, especially seedlings from thickly sown seed. It usually attacks the plants at a joint just above the ground level and, the tissues becoming destroyed, the plants fall over from that point. Excessive dampness, absence of light or ventilation, and imperfect drainage are conditions which are conducive to the disease.

Dry-rot fungus.—The disease known as "dry rot" (*Merulius lacrymans*) frequently attacks timber in bungalows or other buildings in the tropics. Soaking or spraying the wood with a solution of formalin or other fungicide, at intervals of a few days, is said to be the best preventive.

Chlorosis in Plants.—The disease called *Chlorosis*, which means pallor or "green sickness," is not caused by a fungus or insect pest, but by a deficiency of iron in the food of the plant. It is noticeable by the foliage or other actively growing part assuming a blanched appearance, the usual green colouring matter (chlorophyll) being lacking; for without iron no chlorophyll can be formed. It is not a serious or very common disease, and can usually be cured by adding a weak solution of iron salt to the soil.

Fasciation (from "fasciculus," a little bundle).—The primary cause of the phonomenon known as fasciation which affects many families of plants, is largely a matter of conjecture. It may occur in the stem (as often seen in young Hevea stems), as a flattened growth instead of the normal cylindrical stem; or in the flowers, as in the Cockscomb and often in Roses; or in the fruit, as frequently in Pine-apples. Some genera are more liable to it than others, and in some cases it is hereditary, as in the Cockscomb (*Celosia cristata*). Fasciation is believed to be usually the result of either of two causes, viz: (1) local injury to the plant whether caused mechanically or by insects (gall mites being a frequent cause), and (2) excessive nourishment (*hypertrophy*), i.e. overfeeding of certain parts of the plant, which disturbs the equilibrium of growth.

TABULAR LIST OF COMMON FUNGUS DISEASES OF PLANTS IN CEYLON,

Arranged According to Crops Attacked

Host plant.	Name of disease and fungus.	Parts attacked.
Albizzia	Root-disease (*Ustulina zonata*).	Root
Bean, Broad and French	Rust (*Uromyces fabae*).	Leaf
Bread-fruit	*Phytophthora sp.*	Fruit
Cabbage	Club-root (*Plasmodiophora brassicae*).	Root
Cacao	Canker (*? Nectria striatospora*).	Stem
	Brown root-disease.	Root
	Phytophthora sp.	Pod
	Diplodia cacaoicola.	Stem
Camphor	Brown Root-disease.	Root
	Rosellinia bothrina.	,,
Castilloa	Collar-rot (*Fusarium sp*).	Stem
Castor-oil Plant	Rust (*Melampsorella ricini*).	Leaf
Citrus family	Scab (*Cladosporium sp*).	Leaf and fruit
	Ustulina zonata.	Root
	Black rust (*Meliola sp*).	Leaf and fruit
Cinnamon	*Cephaleuros parasitica* (Algae).	Leaf
	Grey Blight (*Pestalozzia palmarum*).	,,
	Witches' Broom (*Exobasidium cinnamomi*).	Stem
Clove	*Fomes substygius.*	,,
	Red Spot (*Cephaleuros parasitica*).	Leaf
Coconut	Grey Blight (*Pestalozzia palmarum*).	,,
	Stem Bleeding-disease (*Thielaviopsis paradoxa*).	Stem
	Fomes lucidus.	Root
	Bud-rot (Bacterial).	Apex
Coffee	Coffee-leaf disease (*Hemileia vastatrix*).	Leaf
Colocasia	*Sclerocystis coremioides.*	Stem
Cotton	Rust (*Uredo gossypii*).	Leaf
Crotalaria	Leaf-disease (*Parodiella perisporioides*).	,,
	Pink-disease (*Corticium javanicum*).	Stem
Dioscorea	Rust (*Aecidium dioscoreae*).	Leaf and stem
Guava	*Gloeosporium psidii.*	Fruit
Hevea	*Fomes semitostus.*	Root
	Sphaerostilbe repens.	,,
	Brown Root disease.	,,
	Pink disease (*Corticium javanicum*).	Stem
	Die-back (*Gloeosporium alborubrum*).	,,
	Botryodiplodia elasticae.	,,
	Canker.	,,
	Leaf-spot (*Helminthosporium hevea*).	Leaf
Mango	Fruit-rot (*Gloeosporium mangae*).	Fruit
	Root-disease (*Fomes lucidus*).	
Mulberry	Rust (*Uredo moricola*).	,,
Nutmeg	Thread Blight (*Marasmius rotalis*).	Leaf and stem
Pea	Leaf-spot (*Ascochyta pisi*).	Leaf
Pepper	Wilt.	Root
Strawberry	Leaf spot (*Sphaerella fragariae*).	Leaf

KNAPSACK AUTOMATIC SPRAYING MACHINE.

SULPHUR OR FINE LIQUID SPRAYER.

Host plant.	Name of disease and fungus.	Parts attacked.
Tea	Grey Blight (*Pestalozzia palmarum*).	Leaf
	Brown Blight (*Colletotrichum camelliae*).	,,
	White-spot (*Cercospora theae*)	,,
	Horse-hair Blight (*Marasmius rotalis*).	Stem and leaf
	Massaria theicola.	Stem
	Brown Root-disease (*Hymenochaete noxia*).	Root
	Root-disease (*Ustulina zonata*).	,,
	Poria hypolateritia.	,,
	Diplodia sp.	,,
	Pink-disease (*Corticium javanicum*).	Branches
	Rosellinia bothrina.	Root
Tobacco	Mildew (*Oidium sp*).	Leaf
	Wilt (*Fusarium sp*).	Root
	Mosaic-disease.	Leaf
Tomato	Pimply Rot (*Phytophthora sp*)	Fruit
	Bacterial-wilt.	Stem
Vine	Mildew (*Oidium tuckeri*).	Leaf

SPRAYING

The object of spraying is to distribute a poisonous fluid in a finely divided form over plants, either for the purpose of ridding them of injurious insects, or for checking the spread of fungus disease. It is carried out by means of hand-pump sprayers, knapsack sprayers, or with compressed air and spraying machines of various designs. Where only a limited number of plants are treated, a garden syringe will answer the purpose. In the case of fungus diseases, it should be remembered that spraying is essentially a preventive, which, to be successful, should be applied at the first signs of the disease. Spraying operations are generally best carried out when the foliage is in a moist condition. Emulsions containing kerosene in any form should be used in cloudy weather only, or after sunset.

Dangers of spraying.—As all insecticides and fungicides are necessarily of a poisonous character, discretion must be used in applying them over fruits or vegetables that will be consumed for food. As the fruits ripen, the spray-fluid should be further diluted, withholding it altogether when it is judged to be desirable to do so. On quick-maturing vegetables or salads, as Lettuce, etc., which are eaten in an uncooked state, it is obviously unsafe to apply any poisonous sprays. Fruit trees should not be sprayed when in blossom, as apart from any possible danger of the poison lodging in the ovary it may seriously affect the setting of the fruit.

CHAPTER XXX.

TRANSPORT OF PLANTS, SEEDS, FLOWERS, SPECIMENS, Etc.; STORING OF SEEDS

The conveyance of plants or seeds over long journeys, or from one country to another, is a question which not unfrequently confronts one in the tropics, and upon it may depend the beginning or development of a new planting industry. In cases where seeds are not procurable, or are of a particularly perishable nature, recourse must be had to plants to meet requirements. Unquestionably the best means so far invented for transmitting plants over long journeys, especially by sea, is in wardian cases, by the aid of which the exchange of live plants between widely separated countries has been greatly facilitated. Thus the introduction of Rubber, Cacao, and other useful plants from the Western to the Eastern tropics, and others vice versa, is due largely to the excellent wardian cases (and equally perfect packing) which for many years past have been sent out from the great emporium, Kew Gardens, London. A wardian case consists of a large box, with two sloping glazed sides which meet at the top to form a ridge, the two ends being carried up like a "V" inverted, thus Λ The sides are movable, and the glass panes fitted in grooves with putty, being protected on the outside with narrow thin strips of wood, nailed on about an inch apart. A small circular hole, covered by a piece of perforated zinc or other metal, is made in each end near the top for ventilation, and over each of these (inside) is nailed a small box, which is open at the top, so as to catch any sea spray that may get in. Therefore a wardian case when travelling, is nearly airtight, so that very little evaporation or change of air can take place within. The bottom of the case is filled with soil, in which the plants are packed closely together; these are held in position by narrow strips of wood placed transversely, which are firmly secured in position by means of a longitudinal strip of wood placed along on both ends of the latter, being nailed to either side of the case inside. Wardian cases may

be made of any size to suit large or small plants. They have been of the greatest service at Peradeniya in despatching Cacao, Rubber and other plants to different parts of the tropics, more especially when seeds are either unobtainable or are of too perishable a nature to withstand a long journey. When transporting Cacao and other seedling plants in wardian cases, the best way of establishing them so as to stand the journey is to sow the seed in the case, a sufficient depth of good light soil being placed in the bottom for this purpose, so that the seedlings may grow *en route*. When the seedlings are well above ground, thin bamboo twigs may

WARDIAN CASES WITH PLANTS READY FOR TRANSPORT FROM CEYLON TO SOUTH AMERICA.

be placed, across the case, between them over the soil, these being held down by longitudinal strips of wood as explained. The case is then ready for despatch, a liberal watering being given to the contents before the sides are closed down.

PLANT-CASES IN TRANSIT

The success of any method of packing plants will largely depend upon the position assigned to these on board-ship. Obviously they must have access to light and air, but must be

under shade or cover; they should not be placed on the lower main deck if on a long voyage, as they would thus be liable to be injured or killed by the sea spray or breakers. The best part of a ship for plants is, as a rule, the upper or boat-deck, but not too near the engines. Plants in an active state of growth will be benefited by an occasional watering, if this can be given by an intelligent hand. Much also depends on the season. Tropical or hot-house plants can only be transported safely over long journeys during the summer months; while deciduous plants, or those of temperate countries, travel best when in a dormant state, as in the autumn or spring.

Wardian cases.—The following are brief instructions for the guidance of persons sending wardian cases of plants from the tropics. The cases should be kept on *deck*, *under awning* and away from the engines; direct exposure to the sun, especially if the cases are closed, will injure the plants. A wardian case is easily opened by unscrewing one or both of the glass sides. In tropical seas during fine weather, one of the glazed sides may with advantage be left partly or fully open during the day. The plants may be lightly watered or sprinkled with fresh tepid water at least once in three days. In cool latitudes less watering is required, and the cases should then be protected at night with tarpaulins or additional covering.

PACKING AND TRANSPORTING SEEDS

In regard to imported seeds of annuals, vegetables, etc., of temperate countries, it has been found that, provided the seed is properly dried, the best way of transporting them is in airtight tins. Seedsmen who make a speciality of sending such seeds on long journeys pack them in hermetically sealed tins, in a dry atmosphere, so that the seeds are not affected by heat and sweat on the voyage. No packing material of a preserving kind is thus required. A similar method will suit certain tropical seeds; but these are often of a fleshy non-driable character, naturally unadapted to a dormant period, and require to be packed with a dry (or very slightly moist) absorbent material; the tins or boxes containing them should not be hermetically sealed, as otherwise fermentation will set in and destroy the seed. Thus, seeds of Para rubber (*Hevea brasiliensis*) which are normally of short vitality, packed in ordinary biscuit tins, with a mixture of dry powdered charcoal and fine soil or coir-dust, have been transported over journeys of six to eight weeks, and at destination gave germinative

results of seventy to eighty per cent. Seeds which are surrounded by a mucilaginous substance should have the latter washed off, then be rapidly dried in the sun, after which they should be packed with a dry preservative material as described above, and despatched without delay. To this class of seed belong Castilloa, species of Garcinia, Nephelium, etc. The writer has found in the case of such as these that if the seeds, while moist and after being washed, are mixed with dry charcoal powder, the latter upon drying forms an effective preservative coating around them. Dr. Van Hall, late Director of Agriculture for the Dutch West Indies, states that he had success in sending Cacao pods in paraffin wax to Java, a voyage of over six weeks, and describes his method thus: "The pods were first thoroughly washed with a tooth-brush and soapy water, then placed in 70% alcohol for a minute, and afterwards in a 5% solution of corrosive sublimate for a few minutes, so as to kill the germs on the surface. A piece of string being then attached to the stalk end of the pod, the latter was dipped in the liquid paraffin (70%); it was taken out immediately and hung carefully by the string so as not to break the thin coating of the wax. When cold, each pod was again dipped in the paraffin, making the coating more secure. The fruits were then packed in fine sawdust and despatched."

Cacao seeds, when shelled, rapidly lose their germinating power, but for journeys not exceeding a fortnight pods may be transported in open crates; the fruits being placed vertically in layers of a dozen each, and separated and held in position by thin strips of wood or bamboo, a convenient-sized crate would hold four dozen pods.

Seeds of a very perishable nature should be packed only in small quantities, and in such tin boxes as do not effectually prevent the escape of moisture. If transmitted by post, stout canvas should be used as an outside covering, or if sent as steamer-freight they should be placed in wooden cases. Coir-dust when leached and intermixed with a proportion of powdered charcoal forms an excellent packing material for many short-lived seeds, such as those of Para rubber. Burnt rice and saw-dust are also used with good results. As a rule, any such packing material should have only the slightest trace of moisture left in it. On the other hand, seeds of certain water-plants, as *Victoria regia*, are best transported in small tubes or vials filled with water; these being made water-tight with wax may easily be packed with straw

or shavings in a section of bamboo, and despatched by post. Palm seeds and most fruit-tree seeds are best packed with slightly moistened sphagnum moss, in tins, or well-wrapped in oil-paper.

Cuttings or Scions may often be safely sent by post if prepared and packed in the following manner. They should be approximately 9 to 10 in. long and furnished with about 3 or more eyes (buds); they must not be too slender, never under the size of a lead pencil in thickness, but preferably a little larger than this in the case of soft-wooded kinds. See that each cutting, etc., is not affected with any insect-pest or fungus disease. About 3 cuttings may be placed together and wrapped in slightly moistened sphagnum moss and surrounded with oil-paper; these may be placed in bundles in a close-fitting tin tube and despatched. In the absence of sphagnum, a slightly damped wrapper of lint or cotton will answer the purpose. Closing up of the ends of the cuttings with sealing-wax to prevent the evaporation of moisture, or fixing the ends in a potato or other tuber, are both useful methods in an emergency, but not to be preferred to the mode described above.

Transport of bulbs or tubers.—These are always best transported when the plants are in a dormant or resting state. In the tropics, however, this is not usually practicable, as the plants may be said to be seldom in that condition. In this case the bulbs or tubers should be gradually dried until all the leaves have thoroughly withered, when they should be cut away. The bulbs may then be packed in dry sawdust or coir-dust for export. Small quantities may thus be placed in ordinary biscuit boxes, and sent by Parcels Post. If packed in a larger box for shipment, it is well to bore a few ventilation holes in the sides of the box.

SENDING FLOWERS BY POST, ETC.

The flowers should preferably be cut with a sharp knife, not broken off; cutting with scissors is apt to squeeze and close the tubes of certain flower-stalks, thereby preventing the absorption of moisture when placed in water. Flowers should be cut in the early morning, when they are full of moisture; do not sprinkle water on them, and if wet shake them gently. In packing, the box should be lined with glazed paper, moss or fresh leaves; no cotton-wool or other absorbent substance should be used as a packing, the best material for the purpose being fresh leaves or fern fronds. The flowers should be packed quite closely, for they will shake down, and if loose the jolting will bruise them; they

are best not tied in bunches, except in the case of small flowers, as violets. A tin box, rather shallow, or, if deep, provided with movable trays, is the best receptacle for sending flowers long distances either by rail or post, but a card-board box may answer if strong enough.

SENDING SPECIMENS BY POST OR RAIL

Parcels should always contain the name of the sender. It is important that specimens of plants or fungi for identification, plants attacked by disease, economic products, etc., should arrive in as fresh a condition as possible. They should be packed in a closely-fitting tin or wooden box, without air holes, both to keep them fresh and to prevent the escape of dangerous insects or fungus spores. Plants for simple identification may be packed flat. Ample material should be sent to allow of full examination, and when flowers or fruit are available these should accompany the specimen. In most cases it is impossible to determine the identity of a specimen with certainty unless accompanied by flowers or fruit. Full notes of the locality from which the specimen comes, with elevation, should be given.

DESPATCHING INSECT PESTS, Etc.

Small insects may be enclosed and despatched in empty match boxes, if on short journeys only. A few pieces of crumpled soft paper should be included in the box to prevent damage by shaking during transit. Larger insects, or such as are likely to eat their way through a match box, should be packed either in tin or wooden boxes. Loose pieces of wood or earth should not be put in a box with insects, as, by rattling about during transport, they would be liable to injure the specimens. It is unnecessary to punch holes in the box for ventilation. The address and postage stamp should be on a separate label to be attached to the box or package, and the sender's name should always be written on the label.

STORING OF SEEDS

Except for convenience, it is perhaps never advisable to keep seeds for a long time,* as most, if not all, seeds germinate best when fresh, provided they are perfectly matured. All seeds may be divided into dryable and non-dryable classes. To the latter belong a large proportion of seeds of tropical species, and these

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* Seeds of Ceara Rubber are often kept for about two years before sowing, as they are considered to germinate best at about that age.

are best sown as soon as possible after they are ripe. Their vitality may, however, be usually prolonged for a limited period by placing them in a dry porous mixture, such as charcoal, burnt paddy husk, coir-dust, sawdust, finely sifted dry soil, etc. Small dryable seeds, having been thoroughly dried, are best kept in stoppered bottles or air-tight tins, which afford protection from weevils and other destructive insects, as well as from the baneful effects of damp and mould. Imported seeds, especially those of annuals and vegetables, which are not sown immediately after arrival, should always be stored away in air-tight tins or stoppered jars, and kept in a cool place until required; otherwise they will soon become useless. Where this is impracticable, as in the case of paddy and other grains, naphthalene is an excellent preventive against weevils and other insects.

CHAPTER XXXI.

1. RECIPES FOR MAKING JAMS, PRESERVES, ETC.
2. USEFUL REFERENCES
3. WEIGHTS, MEASURES, AND COINAGE

RECIPES:—

Billing Jam.—Prick the fruit well over with a fork; let it soak in a basin of water for a night. Then squeeze the fruit slightly to get rid of some of the acid juice, throw away the liquid, and boil the fruit with its weight of sugar until it is of the proper consistency. See preserves, etc.

Cape Gooseberry or Tippari jam. Wash the fruit and put in a pan with sugar, allowing a cupful of sugar to every cupful of fruit; add a teacupful of cold water and boil till done. See jellies.

Melon Jam: To every 18 lb. of fruit allow 12 lb. of sugar, 6 lb. lemons, ¼ lb. bruised ginger tied in a muslin bag. Peel fruit over night and cut into small blocks; put into a large basin (after weighing), and sprinkle over a little of the sugar. Next morning put into the preserving pan with the remainder of the sugar, and while it is boiling pare the lemons and squeeze out the juice, which strain and add to the melon. Put the lemon rinds on to boil in plenty of water, and when they are soft cut into strips with a sharp knife and add to above. Boil for four hours, and remove the ginger bag. The jam should be transparent and of a golden brown colour.

Papaw jam: Choose fruit three-quarters ripe; remove all skin and seeds; chop up the fruit into small pieces. Weigh, add equal weight of sugar, also some green ginger (cut into small slices), 2 oz. of the latter being sufficient for 6 lb. of fruit. Cover up the fruit and sugar, and let the latter melt during the night. Boil up next morning until done.

Passion-fruit jam: Have two basins ready; cut the fruit in halves, scoop out all the juice and seeds into one basin, putting the shells in the other; cover the latter with cold water and a very little salt, and leave in water for twelve hours; then boil in the same water for three-quarter of an hour, scoop out the inside of the shells, throwing away the outside skins and the water they were boiled in. Squeeze out the juice from the seeds. Mix all together and boil for half an hour. Allow 1 lb. sugar to 1½ lb. fruit.

Peach jam: Pare and stone the fruit, after which weigh it, allowing 10 lb. of sugar to every 12 lb. of fruit. Put the fruit in a preserving pan and barely cover with water; allow this to cook slowly for 1½ hours, at the end of which time add the sugar, and cook for an hour longer.

Pine-apple jam: Peel the pine-apples and chop them up (not taking cores); weigh the fruit, and allow 1½ lb. sugar to 1 lb. fruit; boil until of the desired consistency. A piece of cinnamon added will improve the flavour.

Orange marmalade.—Ingredients: 1 lb. orange, 3 pints water, 3 lb. sugar. Mode: Halve and quarter the oranges, take out core and seeds, then slice very thinly and let stand in water for 24 hours; boil in that water until marmalade is as clear as amber. When it has boiled for twenty minutes, add the sugar and let boiling continue till it jellies.

JELLIES :—

Cape Gooseberry or Tippari jelly: Boil and strain the fruit, put the juice on fire to simmer; skim it and add sugar in the proportion of three or four parts to one part juice (or to taste), and cook till it jellies. See also under jams.

Guava jelly: After thoroughly washing the fruit, put in an enamelled saucepan with sufficient water just to cover it; boil until all the fruit is broken, then strain; to one breakfast cupful of juice add the same quantity of sugar or slightly more (say 6 cupfuls juice to 6½ of sugar), and boil very slowly. A little lime-juice may be added after the sugar is put in.

Lovi-lovi jelly: Boil the fruits thoroughly and take off the scum as it comes up. Then strain, and boil with refined sugar (two to one) till it forms a jelly.

Nutmeg jelly: Take 3 lb. nutmeg skins and 4 lb. sugar. Peel the skins and put into water for 12 hours; then take them out and place in enough water just to cover them and boil until quite mashed; strain off the juice, add the sugar, and boil slowly till it jellies.

Another recipe: Put the rinds of ripe nutmegs into a preserving pan, with just enough water to cover them; boil until the fruit is almost a pulp or very soft; then strain through a flannel jelly bag. To every pint of juice add 1 lb. sugar, and boil until jelly is formed.

Rozelle jelly: Place the rozelle sepals in a basin and barely cover with water; let them soak all night, and in the morning slightly squeeze them: put the whole (sepals and water) into a preserving pan and boil until quite soft and pulpy. Then let the juice drip slowly through a jelly bag. Allow 1 lb. sugar to 1 pint juice; boil all slowly for 15 or 20 minutes, or until a jelly is formed.

PRESERVES, FRUIT SALADS, ETC:—

Billing preserve: Prick the fruits with a fork and put them in water for a few hours; then squeeze out the fruits, wash them with hot water and dry with a clean towel. Sugar (in the proportion of 1½ lb. to 1 lb. fruit) should be boiled separately and refined as for nelli preserve; add the fruits to the sugar and boil till the latter comes to a thick syrup. See *Jams*.

Camaranga preserve: Cut off the ends and sharp ridges of the fruit; prick with a fork and put in cold water for a few hours. Squeeze out and pass through hot water before putting the fruits in the sugar syrup, and boil as other preserves. Proportion of sugar, two parts to one of fruit.

Cashew-nut toffee: Take 2 lb. sugar, 150 cashew-nuts (skin these like almonds, in hot water), and chop up with a knife or mincing machine. Make a syrup first of the sugar with 2 tumblers of water, then add nuts and cook till it crystalizes; put on to a buttered plate, and when set cut into squares or diamond shapes.

Mango preserve: Take fruits which are three-quarter ripe, peel off skin, cut into slices, discarding the seed. Prick the fruit with a silver fork, and soak in cold water for a few hours. Prepare sugar (1 or 1½ lb. to 1 lb. fruit) as for nelli, and boil till the fruit is cooked.

Nelli preserve: Prick fruits when half-ripe, wash and prick all over with a silver fork. Squeeze the juice out by hand, and soak in cold water for about 12 hours; put the fruits in boiling water for a little while, and again squeeze out the juice. Add sugar in the proportion of 2 lb. to 1 lb. of fruits; boil sugar separately, then add the fruits and boil till all becomes a thick syrup.

Pine-apple preserve: Slice the fruit, prick it or chop in pieces, but do not squeeze out the juice. Then boil with refined sugar (one to one) as for nelli; add a small piece of cinnamon and a few cloves to flavour.

Pumpkin toffee: This is made like cashew-nut toffee, allowing 1 lb. sugar for 1 lb. of pumpkin, grated like coconut; add ¼ lb. of flour and, when it is inclined to crystalize, a table-spoonful of butter. When set, cut into squares.

Mango chutney: Take 1 lb. unripe mangoes, 1 lb. Demerara sugar, ½ lb. sultanas, 2 oz. almonds, 2 oz. garlic, 2 oz dried ginger, 2 or 3 oz. dry chillies, and salt to taste. Peel the mango, slice from the seed and cut into small pieces, chop the sultanas and almonds; grind the garlic, ginger and chillies on a curry stone. Mix all with half-bottle of malt vinegar and boil for twenty minutes, stirring all the time.

Devilled Bananas: Melt 1 table-spoonful of butter, add ½ tea-spoonful of chopped red chillies, 2 tea-spoonfuls chopped pickles, 1 tea-spoonful Worcester sauce, and ¼ tea-spoonful of salt. Add four bananas cut in four equal parts. Cook five minutes.

Banana Sauce: Ingredients: ¼ pint water, ¼ lb. sugar, 3 bananas pulped, 3 table-spoonfuls lemon juice, 2 eggs, and a pinch of salt. Boil sugar and water ten minutes. Mix remaining ingredients, and pour hot syrup on to them. Beat well, and serve hot.

Banana compote: Ingredients: Sound ripe bananas, ¾ pint white syrup, ½ liqueur-glassful maraschino, chopped almonds, and a few grapes. Peel the bananas, remove the white fibres in core or centre, plunge the fruit into boiling water for two seconds. Drain at once and transfer the fruit into boiling syrup, kept ready for the purpose in a saucepan or basin. Cover with a plate and leave to cool, then add the liqueur. Take out the bananas, dish up in a pyramid garnished with large grapes (which have been cut in halves and had the stones removed). Pour the syrup over and serve.

Fruit Salad: Peel and clean with a silver knife any fruit available, as pine-apple, mangoes, plantains, oranges, papaws, etc. Slice the fruit, cut into neat squares, and place in a glass dish. Sprinkle with castor sugar; mix well and, if liked, add one pint of hock or sherry. Fresh whipped cream, Fussell's tinned cream mixed with sugar and vanilla, or a good custard, should be served with this salad, which improves by being kept in a cool place. ("Hausfrau" in *Ceylon Observer*).

Vegetable curry: Take 3 carrots, 3 turnips, 3 potatoes, 1 onion, 2 table-spoonfuls curry powder, 1 apple and some boiled rice. Scrape the carrots and cut in slices; peel the turnips, potatoes, onions and apple, cut in slices, and

fry in dripping until a nice brown; put all in a deep pie dish; mix the curry powder with a ¼ pint of stock and pour over the vegetables; cover the dish with a plate, and simmer in the oven for one hour.

SWEET-POTATO RECIPES :—

"Biscuit"—Mash thoroughly four medium-sized cold, boiled potatoes, after removing the skin; stir in 4 table-spoonfuls of flour with a piece of butter the size of a small egg, and add milk to make the consistency of biscuit dough. Roll, cut, place in a well-greased pan, and bake in an oven with moderate heat.

"Waffles."—Add to two heaping table-spoonfuls of boiled potatoes, rubbed through a cullender, a table-spoonful of melted butter, a table-spoonful of sugar, a pint of milk, four table-spoonfuls of flour, one egg well-beaten, a little salt, two tea-spoonfuls of baking powder. Grease the irons thoroughly, fill, and bake brown. Serve with a sauce of half tea-cupful of honey beaten with a tea-cupful of cream.

"Pudding."—Remove the skins of and mash finely six potatoes; beat with yelks of four eggs a tea-cupful of white sugar and four level tea-spoonfuls of butter. Beat the whites of two eggs as for icing, add grated rind and juice of a small lemon, a little salt, and two tea-cupfuls of cream; stir, then add to other mixture. Put into a buttered dish, and bake an hour and a half. Beat whites of eggs with three table-spoonfuls of sugar, pour over the top, and brown.

USEFUL REFERENCES :—

[*S.*=Sinhalese; *T.*=Tamil].

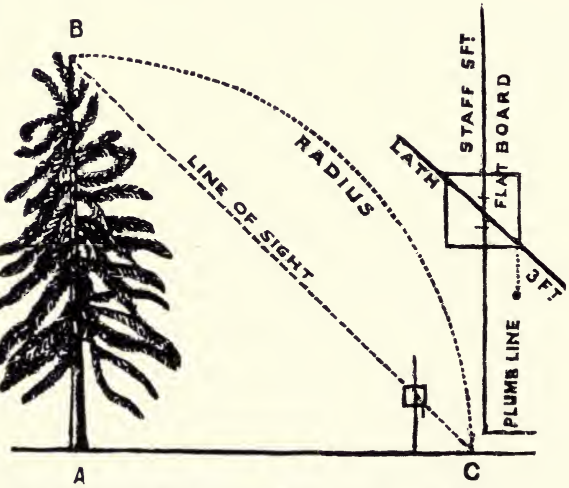
To make Charcoal. Cut the wood in lengths of 2 to 3 feet, and split the stout pieces 2 or 3 inches in thickness. Heap these into a wide pit, commencing by making a square chimney in the centre with sticks about 15 inches long laid across each other; pile the wood around this, one piece upon another, laid as closely as possible. Cover the whole with turf or adhesive earth, except the top of the chimney; start the fire in the chimney at the base with dry kindling. Carefully stop all outbursts of smoke with soil, and close or open the draught holes (left at the base) according as the fire burns. When the fire is completely extinguished allow the mass to gradually cool.

Woods for making Charcoal. The following are some of the best charcoal-making woods in Ceylon :—*Acronychia laurifolia* ("Ankenda" *S.*), *Adenanthera pavonina* ("Madatiya" *S.*), *Artocarpus nobilis* ("Del" *S.*), *Bassia longifolia* ("Me" *S.*), *Caryota urens* ("Kitul" *S.*), *Croton lacciferum* ("Keppitiya" *S.*), *Doona zeylanica* ("Dun" *S.*), *Hemicyclia sepiaria* ("Vira" *S*; "Viyarai" *T.*), *Trema orientalis* ("Gedumba" *S.* or "Charcoal-tree"), *Wendlandia notaniana* ("Rawan-idella" *S.*)

Measuring the Height of Trees. Take a staff six feet long, pointed for pressing into the ground. To the centre of the staff fix with screws a piece of board twelve inches wide and exactly square. Fix to this a diagonal strip of straight lath. A plumb line is attached to the board of staff to enable the perpendicular being obtained; this is indispensable. In measuring a tree the staff is placed at a distance from it, so that with the plumb exactly perpendicular the diagonal lath points to the top of the tree, the person taking the "sight" resting on one knee or reclining to bring the eye to the lower end of the lath.

The sight line is then extended to the ground by means of a string. From the point where this touches the ground (C in the figure) to the centre of the trunk will represent the actual height of the tree; that is, the horizontal line A C is equal to the vertical A B. If the tree were blown or cut down its top would follow the course showed by the curve line and rest at C.

Another method. Make two lines on the ground exactly three feet apart. On one of the lines drive a stake in the ground so that the top of the stake will be exactly three feet from the ground; when the shadow of the stake will have reached the other line, the shadow cast by the tree will be precisely the length of the height of the tree, and by measuring the length of the shadow at that moment you will obtain the exact height of the tree. The measurements should be taken on level ground. If the tree is leaning, incline the stake at as nearly the same angle as possible at which the tree inclines.



MEASURING THE HEIGHT OF TREES

Measuring land. The following lengths multiplied by the corresponding breadths equal an acre :—

988 yds. long and	5 yds. wide.	110 yds. long and	44 yds. wide
484 „ „	10 „ „	88 „ „	55 „ „
220 „ ,	22 „ „	69½ „ „	70 „ „
121 „ „	40 „ „		

A yard is a good long stride, and few men step a yard in their natural stride.

To measure Timber. Take the girth in inches in the middle, divide it by 4, and square the result, which gives the mean sectional area of the trunk ; multiply the product by the length of the tree in feet, divide by 144 and the quotient is the contents in cubic feet. Where there is bark, an allowance must be made for this. The usual allowance varying from ½ inch to 1½ inch to every foot of quarter girth ; thus, the total quarter girth being 24 inches, and the bark being thick, a deduction of 5 inches or 3 inches would be necessary, the quarter

girth being taken at 21 or 22 inches. The height of standing trees may be judged by using a 20-foot rod, and the girth by taking a girth-strap 12 feet in length and about ¾ inch wide, on which every fourth inch is numbered from one to thirty-six. Thus a tree having a circumference of 120 inches would read 30 inches on the strap.

Weight or measurement of Straw or Hay Stacks. To measure an oblong stack, multiply the length in feet by the width below the eaves, and the product by the height from the ground to the eaves. For the top, multiply the length in feet by the width at the eaves, and the product by half the length to the ridge. A cubic foot of hay weighs approximately from 7 lb. to 9 lb. For general purposes the weight of a stack may be ascertained by actually measuring the cubic contents of the truss, and calculating from this the weight of a cubic foot. Stacks of straw are estimated at from 18 to 20 cubic yards to a ton.

To estimate Grain crops per acre. Frame together four light sticks, measuring exactly a foot square inside, and with this in one hand walk into the field and select a spot of fair average yield; lower the square frame over as many heads as it will enclose, shell out carefully the heads thus enclosed, and weigh the grain. To make the result more reliable, make ten or twenty similar calculations, and estimate by the mean of the whole number of results.

Approximate cost per acre of bringing crops to maturity in Ceylon.—Coconuts, £25 up to 6th year; Tea, £30 to £35 up to 4th year; Cocoa, £25 to £30 up to 5th year; Rubber, £30 up to 6th year. These figures include the necessary factory or store, but not the cost of land. From £5 to £10 more per acre may be allowed, under average conditions, for the Straits Settlements and F.M.S.

Road-making and Concreting.—A cube of broken metal is 18 feet long at base, 5 feet broad, 2½ feet high in centre and 14 feet long along top ridge. It contains 60 bushels of metal which, when spread, is sufficient for metalling about 500 sq. feet of road surface. Usual cost at quarry, about Rs. 8. Concrete metal is 50% finer (= road metal broken in half); cost per cube at quarry, Rs. 12·50. The usual charge for concreting, 4 inches thick, varies from 25 cts. per sq. foot according to locality.

Average day's work per cooly:

Holing 18 in. × 12 in.	(as for Tea)	...	100 to 120
Planting	(Tea)	...	200 to 250
Drains 18 in. × 15 in.	...	...	50 to 60 ft.
Pruning	(Tea)	...	180 to 300 trees

Tea-box woods. The following Ceylon woods are among the most suitable for making tea-chests. Katu-imbul (*Bombax malabaricum*); Mango (*Mangifera indica*); Hal (*Vateria acuminata*); Katuboda (*Cullenia excelsa*); Kekuna (*Canarium zeylanicum*); Ruk-attana (*Alstonia scholaris*); Malaboda or Wild-nutmeg (*Myristica laurifolia*), Telambu (*Sterculia foetida*).

Moss on Lawns.—The best way to get rid of moss on lawns is first to afford efficient drainage, and afterwards enrich the soil. The moss should be eradicated by scarifying the surface with an iron-toothed rake in order to detach it, afterwards raking it off. When this has been done, top-dress the lawn with a rich compost of good soil, decayed manure and wood ashes. Use two parts of soil and one part each of the other ingredients, passing them through a fine

screen, and applying at the rate of one cartload to every forty square rods. Should the soil be of a dry nature, add 7 lb of bone-meal to each square rod. If moist, use a similar amount of basic slag. Once a year apply ½ lb. of nitrate of soda to each square rod in the case of dry soils, and a similar quantity of sulphate of ammonia in that of a moist one. Where the grass is very thin, sow a mixture of grass seeds.

Rainfall.—The depth of rainfall in inches multiplied by 3,630 equals number of cubic feet per square acre; multiplied by 22,623, equals number of gallons per square acre.

Thus:—

Inches.		Cubic feet per acre.		Gallons per acre.		Tons per acre
1	=	3,630	=	22,635	=	101·1
2	=	7,260	=	42,270	=	202·2
3	=	10,890	=	67,905	=	303·3
5	=	18,150	=	113,174	=	505·5

Material for (and cost of) Cart wheels. The most generally used woods in Ceylon for making cart wheels are "Hal-milla" (*Berrya ammonilla*), "Suriya" (*Thespesia populnea*) and "Ratu-wa" (*Cassia marginata*). The usual quantity of two ordinary cart wheels of 4½ feet diameter are: 12 pieces for rims @ 50 cents each; 24 spokes @ 18 cents, two hubs @ Rs. 3, total for two wheels Rs. 16·32. Iron tyres and bushes, about Rs. 10 extra. To this must be added the cost of labour (carpentry), viz., about Rs. 14, in all say Rs. 40.

To revive flowers. Rinse the stalks in fresh water and put into warm salt-water, to which has been added a few drops of sulphate of ammonia. As each flower is ready to be placed in the vase of fresh water, snipp off a small portion of the stalk with a sharp pair of scissors. To keep a spray of arranged flowers fresh, place them on damp cotton-wool under a basin. This keeps the air away, and preserves their freshness. It is specially recommended for maiden-hair fern.

To prepare Skeleton leaves. Mix about one drachm chloride of lime with one pint water, adding sufficient acetic acid to liberate the chlorine. Steep the leaves in this until they are whitened (about 10 minutes should suffice), taking care not to leave them in too long. Then put them into clean water and float them out on pieces of paper. Lastly remove the fronds from the paper before they are quite dry, and place them in a book or press. They look best when mounted on black velvet or paper.

To preserve fern fronds. Reject very young fronds, as they will lose their colour in drying. Place the selected fronds between several sheets of blotting paper, and pass over a moderately heated flat iron for several minutes. Use only, however, will determine how long to continue the ironing, as ferns vary in the thickness of their fronds. Then place separately in a book, and lay aside for a day or two previous to mounting. To do this, smear the sheet of paper over with liquid gum, lay the reverse side of the frond on the gummed surface, press gently, remove, and place carefully on the paper where you intend it to remain. Finally pass over a piece of blotting paper to remove creases.

To drive away sparrows from bungalows, etc.—Smear a few thin twigs with any sticky substance, as bird-lime, seccotine, or the resinous

gum from jak-fruit; place these at intervals where the sparrows collect, and they will soon disappear.

To make Bird lime. Boil ½ pint linseed oil, and while boiling add a lump of resin about the size of a hen's egg. Add two tea-spoonfuls of treacle and stir frequently while cooling.

A simple fly-trap. Pour some water into a finger-bowl, or other wide-mouthed vessel, till the surface of the liquid is about an inch from the brim. Add a small quantity of oil (coconut or castor) to make a superficial film. In the centre of a piece of card-board, sufficiently large to cover the vessel, cut a small hole about ¼ inch in diameter. Smear some condensed milk or honey on one side of the card-board round the central aperture, and place the card-board over the vessel so that the smeared side is below. The flies will creep into the enclosed space and meet with an oily grave. A tap on the card will at once precipitate all those resting on its under surface. The oil-film is necessary, as flies are not easily wetted by water alone, from which they often succeed in saving themselves.

Book preservative. I have found the following an excellent preservative for books, as well as a preventive against insects and moulds, which are so destructive to books in the tropics: Dissolve Canada balsam in turpentine, say 2 oz. of the former to 4 oz. of the latter, so as to make a weak solution; paint this over the covers or bindings of the books, and let them stand a few hours to dry.

Another recipe. Paint the books lightly over both outside and inside the cover (and especially along the backs, where paste has been used), with the following mixture, using a soft brush for the purpose: 1 oz. corrosive sublimate; 1 oz. carbolic acid; 2 pints methylated spirit. No harm will be done to the books, and after the mixture has dried they may be handled with perfect safety.

USEFUL FERTILISING MIXTURES.

No. 1	Nitrogen.	Phos. Acid.	Potash.	Approximate proportion of plant food.	
450 lb. Groundnut Cake ...	7%	—	—		
250 „ Fish Guano ...	8%	8%	—	Nitrogen ...	61·0
150 „ Steamed Bone-dust ...	3%	22%	—	Phos. acid ...	53·0
100 „ Sulphate of Potash ...	—	—	50%	Potash ...	67·5
50 „ Nitrate of Potash ...	10%	—	35%		
1,000 lb. Cost F.O.R. Colombo, Rs. 154 per ton.					
No. 2.					
200 lb. Nitrolim	18%	—	—	Nitrogen ...	36·0
150 „ Basic Slag ...	—	20%	—	Phos. acid ...	30·0
100 „ Sulphate of Potash ...	—	—	50%	Potash ...	50·0
450 lb. Cost F.O.R. Colombo, Rs. 146 per ton					

Quantity: For small plants or shrubs, 2 oz. of each mixture.
„ large shrubs or medium trees, 1 lb. of each mixture.
„ „ trees or palms, 3 to 4 lb. „ „

Either of these mixtures may be applied annually, or they can be alternated with advantage, or if necessary mixed just before application and applied in one dressing.

Apply the manure in a shallow channel round the base of the trees or plants, at a certain distance from the stem, varying from a few inches in the case of small plants to 2-4 ft. in the case of medium or large sized trees or palms; fork well into the ground, or cover with a sprinkling of soil; if the weather be dry or the plants are under cover, water the ground afterwards through a rose.

DRY GRAINS CULTIVATED IN CEYLON

Andropogon Sorghum. Indian millet; Karal Irungu, *S*; Arisecholum, *T*.

Coix Lachryma-jobi. Job's tears. A robust grass with broad leaves, 3-5 ft. high, common in Ceylon and cultivated in some hill parts of India for its grain.

Eleusine coracana. Kurakkan, *S*; Nacheri, *T*. A stout grass with crowded spikelets and round seed, extensively cultivated for its grain in Ceylon and throughout India.

Panicum Crus-galli, var. frumentaceum. Mondy, *T*; Wal-marukku, *S*. Annual, 1-3 ft. high; grain consumed by the poorer classes.

Panicum miliare. "Heen-meneri," *S*; Chamai, *T*. Annual, with tufted stems, 1-2 ft. high, cultivated in Ceylon, India, etc.

Panicum miliaceum. Millet; Meneri, or Wal-meneri, *S*; Karattasamy or Pani-Chami, *T*. Annual, 2-4 ft. high, stout tufted stems. Cultivated in Ceylon and all warm countries.

Paspalum scrobiculatum. Amu or Karal-amu, *S*; Waraku, *T*. Perennial, 2-3 ft. high, leafy from the base; several varieties cultivated for grain.

Pennisetum typhoideum. Bulrush millet; Pull-paddy; Polu, *S*; Kumba or Kani-pun-pillu, *T*. Annual 3-6 ft. high, cultivated in warm regions.

Setaria glauca. Kawalu, *S*. Stems 1-2 ft. high, spikes reddish brown. Common all over Ceylon.

Setaria italica. Italian millet; Tana-Thani or Tanakal, *S*; Tinai or Tinai-Chamai, *T*. Cultivated in India and Ceylon and considered one of the most delicious of dry grains.

Zea Mays. Maize, Indian corn; Bada Irungu, *S*; Muttu Cholam, *T*.
See under *Vegetables*.

PLANTS OR TREES SUITED TO SWAMPY SITUATIONS

FOR LOW ELEVATIONS:

Anacardium occidentale.	Cashew-nut
Barringtonia speciosa.	Mudilla, *S*
Bœhmeria nivea.	Rhea or Ramie-fibre
Carludovica palmata.	Panama-hat plant
Cerbera Odollam.	Gon-kaduru, *S*.
Cyperus Papyrus.	Papyrus-grass
Fodder grasses, which see	
Hevea brasiliensis.	Para rubber
Heritiera littoralis.	Etuna, *S*.
Nipa fruticans.	Water Coconut
Ochrosia borbonica.	Mudu-kaduru, *S*.
Saccharum arundinaceum.	Rambuk, *S*.
Scaevola Koenigii.	Taccada, *S*.

FOR UP-COUNTRY:

Acacia dealbata. Silver-wattle
Eucalyptus globulus. Blue-gum
E.—Leucoxylon. Iron-bark
E.—marginata. Jarrah and other species
Fatsia papyrifera. Rice-paper plant
Fodder grasses, which see
Hedychium coronarium. Elamal, *S.* Recommended for paper-making
H.—flavescens. ,, ,,
Phormium tenax. New-Zealand hemp

(3). SOME WEIGHTS AND MEASURES

CEYLON:

1 Manawa = ½ nelli or 2 chundus
1 Nelli = ¼ kuruni or laha
1 Kuruni = $\frac{1}{5}$ Bera (drum)
1 Bera = ½ pela (bushel)
1 Pela = 1 bushel
1 Amuna = 4 bushels
1 Hundua = ¼ sarua (measure)
32 Measures = 1 bushel
1 Sarua = ⅛ kartua
1 Kartua = ¼ bushel
1 Thulama = 26½ rathals (pounds)
1 Thukku = 56 rathals
1 Parama = 20 thulam or 5 cwt.
1 Candy = 560 lb. or 5 cwt.
4 Candies = 1 ton

WEIGHTS USED BY SINHALESE APOTHECARIES:

1 Thala-eta (gingelly seed) = ⅓ Amu-eta
1 Amu-eta = ⅓ Vee-eta (paddy)
1 Vee-eta = ½ Madatiya-eta (*Adenanthera pavonina*)
1 Madatiya-eta = 1/20 kalanda
1 Kalanda = 1/12 palama
1 Palama = ⅛ rathala (pound)

INDIA:

1 Tola = 180 grains
1 Seer = 14 oz.
1 Maund = 80 lb.
1 Lac = 100,000
1 Crore = 1,000,000
1 Bigha (Nepali)=90 × 90 yds.
1 ,, (Brit. Indian)=40 × 40 yds.
3 ,, (Nepali)=about 5 acres.

MALAY:

1 Tahil = ⅓ oz.
1 Kati = ⅓ lb.
1 Picul (100 katties) = 133⅓ lb.
1 Picul (Java) = 136 lb.
1 Koyan = 5,333 ⅓ lb

DUTCH:

1 Bau (bouw) = 1¾ acres
1 Picul (Java) = 136 lb.

FRANCE, GERMANY, ETC.:

1 Millimetre = ·039 inches
25 Millimetres = 1 in. (about)
1 Centimetre = ·393 inches
30·5 Centimetres = 12 inches
1 Metre = 1 yard 3 inches
1 Kilometre = 1,093 yds. 1 ft. 10 in.
1 Litre = 1¾ pints
1 Kilogram = 2¼ lb. (nearly)
10 Kilograms = 22 lb 0¾ oz.
50¾ Kilograms = 1 cwt.
1 Hectare = 2½ acres
1 Orlong = 1 $\frac{1}{32}$ acres
1 Estrada = 150 Para trees

LOCAL AND FOREIGN MONEY

ARGENTINE:

1 Peso (paper) = 100 centisimos or 1*s.* 9*d.*
1 Peso (gold) = 100 centisimos or 3*s.* 11½*d.*

AUSTRIA-HUNGARY:

1 Krone = 100 heller or 10*d.*

BRAZIL:

1 Milreis (paper) = 1,000 reis or about 1*s.* 3*d.*

CEYLON:

1 Sallie = ½ cent
1 Thuttu = 3 sallies or 1½ cents
1 Panam (anna) = 4 thuttus, 6 cents, or 1/16 Rupee
4 Pannams = 25 cents
100 Cents = 1 rupee
1 Rupee = 1*s.* 4*d.*

INDIA & MAURITIUS:

3 Pies = 1 pice.
4 pice = 1 anna or 1*d.*
16 Annas = 1 rupee
1 Rupee = 1*s.* 4*d.*

MALAY:

100 Cents = 1 dollar
1 Dollar = 2*s.* 4*d.*

DUTCH:

1 Guilder or Florin = 1*s.* 8*d.*
12½ Guilders = £1
1 Stiver = 1*d.*

FRANCE, BELGIUM, AND SWITZERLAND:

1 Sou = ½*d.*
10 Centimes = 1*d.*
1 Franc = 9½*d.*
20 Francs = 16*s.*
25 Francs = £1

RUSSIA:

1 Rouble = 3*s.* 2*d.* or 100 copeks

ITALY:

1 Lira = 10*d.* or 100 centesimi
26 Lira = £1

MEXICO:

1 Dollar (gold) = 100 centavos or 2*s.* 0½*d.*

GERMANY:

1 Mark = 1*s.* or 100 pfennige
20 Marks = £1
1 Prussian thaler = 2*s.* 11½*d.*
1 Rix dollar = 3*s.* 6*d.*

SPAIN:

1 Reala = 2½*d.*
1 Peseta = 10*d.*
25 Pesetas = £1
1 Escudo = 2*s.*
1 Dollar = 4*s.*

PORTUGAL:

25 Reis = 1¼ *d.*
1 Cruzada = 2*s.* 3*d.*
1 Milreis = 4*s.* 5½*d.*

UNITED STATES & CANADA:

1 Cent = ½*d.*
1 Dime = 5*d.*
100 Cents = 1 dollar
1 Dollar = 4*s.* 2*d.*
4·87 Dollars = £1

CHINA:

1 Tael = 6*s.* 6¼*d.*

JAPAN:

100 Sens = 1 yen
1 Yen (gold) = { 4*s.* 2*d.* or 1 gold dollar of U. S. A

ROUMANIA:

1 Ley = 100 banis or 10*d.*

SIAM:

1 Tical (silver coin) = 1*s.* 1*d.* or 50 dollar cents of U. S. A.

TURKEY:

100 Piastres = 18*s.*

URUGUAY:

1 Peso (gold) = 100 centimos or 4*s.* 2*d.*

EGYPT:

975 Millièmes or 97½ piastres = £1

GREECE:

1 Drachme (paper) = 100 lepta or 9*d.*

CHAPTER XXXII.

CALENDARS FOR CEYLON

FOR JAFFNA AND NORTHERN PROVINCE:—

BY S. CHELLIAH, AGRICULTURAL INSTRUCTOR, JAFFNA.

January.—Average rainfall 2·15 in. Gather in the crop of different kinds of yams. Plant tobacco seedlings, also chillies and brinjals. Plantains are generally planted out this month, also the Betel creeper. The latter is the staple cultivation in the west of Jaffna.

February.—Average rainfall 1·31 in. Gather in paddy crops. Sow dry grains, such as gingelly, kurrakan, peas, kollu, etc., soon after the main crops are gathered. Lift Palmyra kilangu (germinated seedlings), which are used as a vegetable. Water tobacco gardens and disbud ("sucker") the plants.

March.—Average rainfall ·93 in. Gather paddy crops and plough vacant paddy fields. The season for extracting the juice from Palmyra palms is from now to the end of May. This cultivation forms an important industry among the lower classes of the people. Manioc (cassava) roots are now lifted and dried to be used as food stuff.

April.—Average rainfall 2·35 in. Brinjals and chillies are now planted. This is the time for planting out coconut plants. Gather dry grains sown in February. Gather and cure tobacco crops all over the North. Gathering and drying of chillies must be done now; also ploughing and manuring paddy fields. Planting out Betel is also done this month.

May.—Average rainfall 2·01 in. This is the time for sowing the dry grain called "Tennai" (Italian millet), after the harvest of tobacco, also for planting manioc (cassava) cuttings and different kinds of yams.

June.—Average rainfall ·79 in. Watering dry-grain plants in gardens will now be necessary, this being the dry season; it is also the fruit season in Jaffna. Plucking arecanuts will be continued to the end of December. This is the time land owners make arrangements to have their garden lands cultivated with tobacco on lease.

July.—Average rainfall ·87 in. Reaping of dry grains sown in May will now proceed, also planting of betel, onions, etc. Palmyra fruit season begins, and continues to the end of September, during which time this forms a great relief to the poor as an article of food.

August.—Average rainfall 1·44 in. Sowing of paddy in fields, also sowing and transplanting of kurrakan in gardens may be done this month

September.—Average rainfall 2·80 in. This is generally a slack month and very little is done, except the sowing of dry grains, as "Varaku" and "Kattusamy" in Palmyra gardens. Palmyra nuts are put in for kilangu.

October.—Average rainfall 6·66 in. Weeding of paddy fields, also transplanting and filling vacancies in paddy fields, should now be seen to. Paddy seedlings are bought at Rs. 2 to Rs. 3 a hundred bundles. Some people sow paddy thickly for the purpose of selling thinned out seedlings at this time. Till and manure fields for tobacco. Tobacco seed is sown in nurseries. Fruit trees may be planted at this season. Planting of areca-nuts may now be done. This palm is commonly planted around wells.

November.—Average rainfall 13·38 in. Generally a busy month for collecting green manure, etc., for tobacco gardens.

December.—Average rainfall 11·34 in. Planting tobacco all over the North should now commence. Onions are planted this month.

CALENDAR FOR COLOMBO DISTRICT

[Average annual rainfall 88 inches]

[Mean annual temperature 80 deg. Fah.]

By C. Drieberg, Superintendent of Low-country Products and Secretary, Ceylon Agricultural Society.

January.—Average rainfall for the month 3·54 in. A fairly dry and cool month, during which little planting is done. A good season for vegetable produce, the result of previous October and November planting. Yams and gourds plentiful. Annual flowers in bloom.

February.—Average rainfall 2·08 in. A particularly dry month when no planting can be done. Seeds should be gathered and the soil worked up as crops go out. Where plants are growing the surface should be stirred to prevent loss of moisture, and beds copiously watered and, when necessary, shaded.

March.—Average rainfall 4·80 in. This is the month for cleaning, digging, and manuring the soil. Occasional showers may be expected. Nurseries, where necessary, should be started.

April.—Average rainfall 11·03 in. Planting begins with this month, when the rainfall is usually plentiful. All varieties of vegetables and flowers may be planted with good prospects of favourable growing weather.

May.—Average rainfall 12·04 in. South-west monsoon rains begin towards end of month, when planting may be continued. Fruits (such as mangoes, oranges, pine-apples, mangosteens, etc.) begin to come in. Many flowering trees in blossom.

June.—Average rainfall 8·27 in. This is the last month of the South-west monsoon for planting generally. Weather fairly wet and hot. Fruits well in season.

July.—Average rainfall 4·61 in. Fruits begin to go out of season; vegetables of April to May planting begin to come in.

August.—Average rainfall 3·67 in. Slack month; weather hot and dry. Vegetables fairly plentiful. Fruits go out of season.

September.—Average rainfall 5·03 in. Weather still dry. All crops fall off. Seeds should be collected, and land worked up for planting again. Nurseries should be started.

October.—Average rainfall 14·67 in. Second planting season begins with the North-east monsoon rains, which are now more or less general throughout the Island. All kinds of crops may be now started, and fruit trees also planted.

November.—Average rainfall 12·38 in. Planting may be continued. The best month for planting tomatoes and gourds in the low-country.

December.—Average rainfall 6·03 in. General vegetable produce begins to come in, also annual flowers. Weather generally cool.

CALENDAR FOR UP-COUNTRY.

[Taking Hakgala Gardens as a Standard,]

[Elevation 5,500 feet; average rainfall 90·86 inches on 203 days; average mean temperature 62° Fah.]

By the late J. K. Nock,* Curator, Hakgala Gardens.

January.—Weather wet, with foggy mornings; latter half of the month often fine. Average rainfall 8·22 inches on 16 days. Mean temp. 58 deg. Fah. The month during which the finishing touches should be given to a garden. Drives, paths, etc., should be attended to. All general planting should be finished early in the month. Fork up frequently the surface of the ground around all young plants; afford mulching with leaf mould or well-rotted cattle manure; a top dressing of artificial manures mixed with fine soil should be given when possible. Liquid manure may be applied to pot-plants once a week, especially to flowering kinds. Phloxes, Verbenas, Petunias, etc., need pegging down as their growth advances. Remove superfluous buds from roses if fine blooms are required. Afford protection to tender plants against frost (as stated for December) during the nights of this and the next two months. Vegetable seeds of all kinds may be sown for keeping up a succession.

February.—Weather dry, with cold nights and mornings, and hot bright days. Average rainfall 3·05 in. on 9 days. Mean temp. 60 deg. Fah. Much watering is usually necessary. Liquid manure may with benefit be applied to bed and border plants. Supply vacancies where necessary. Weed and point over beds and borders frequently. Stake plants needing supports, e.g., Carnations, Antirrhinums, etc. Collect cattle dung for potting work, and cut and stack turf-clods; the latter should be placed grass-side down, with manure between each layer. Pot on flowering plants. Remove fruit capsules from rose bushes. Place clean straw under the Strawberries before they begin to ripen. Vegetables of all kinds, especially those of the cabbage tribe, may now be sown.

March.—Weather dry. Average rainfall 4·54 on 9 days. Mean temp. 62 deg. This should be the brightest month in the flower garden up-country. Routine work as last month,—collect seeds as they ripen. If a

* See preface.

lawn is to be made, prepare the ground early in the month for sowing in April, or for turfing in May or later.

April.—Weather showery. Average rainfall 7·62 in. on 16 days. Mean temp. 64 deg. Sow seeds collected last month, and continue collecting. Cut away dead stems, leaves, etc., from annuals, and pull out unsightly plants that have finished flowering, Keep drains and culverts clean in case of heavy plumps of rain. This is the best month for sowing lawn grass seed. Owing to the approaching monsoon rains, it is not advisable to put down vegetables, as potatoes, peas, beans, and onions until at least the end of July.

May.—Weather showery with strong wind after the arrival of the South-west monsoon about end of month. Average rainfall 6·90 in. on 15 days. Mean temp. 65 deg. At the commencement of the month stake all tall plants in exposed positions. Continue to collect and sow seeds. Where annuals have finished flowering, the ground should be dug up, manured lightly and prepared for planting out with seedlings in June or July. Advantage should be taken of the wet weather for planting pockets in banks, rockeries, etc. Repair turf of lawns where necessary. Except potatoes, onions, and peas, a few vegetables may be put down, although they are liable to be damaged by the strong wind and rain. These remarks apply also to June and July.

June.—Weather generally wet and always windy. Average rainfall 8·13 in. on 19 days. Mean temp. 62 deg. Plant up vacant corners and banks. Put in cuttings of all kinds, especially such as Verbenas and Petunias, which have finished flowering. Stack manure; where necessary lay down turf and repair verges. Prune shrubs and shape trees during this or the next month. Order foreign seeds so as to arrive by the end of August.

July.—Weather moderately wet, but still very windy. Average rainfall 6·02 in. on 19 days. Mean temp. 62 deg. The most difficult month in which to keep a garden tidy, owing to the prevailing strong winds. Clean up all rubbish, and place the leaves in pits to rot and form leaf-mould. Continue planting banks, rockeries, etc. Divide and re-plant violets in sheds. Prune fruit trees generally. Prick out seedlings, and plant out when large enough. Plant-shed roofs should be made rain-proof. Most pot-plants will now require re-potting or top-dressing. When the weather is too wet for out-door work, all pots, pans, boxes, etc., should be thoroughly washed inside and out, and then put away to dry and be ready for the foreign seeds which are due to arrive at the end of next month. Collect good soil, and store away leaf-mould and dried cattle dung. Cuttings of all kinds do well if put in during this month. This is one of the best flowering months for Amaryllids and Liliaceous plants.

August.—Weather fairly dry and pleasant, though often windy. Average rainfall 4·43 in. on 17 days. Mean temp. 62 deg. The foreign seeds ordered in June should now have arrived, but must not be open until everything is ready for sowing them, as most kinds deteriorate rapidly when exposed to the air. Whether pots, boxes, or sheds are used, the soil for sowing in must be fine, light and rich; a sprinkling of sand should be added to render it porous, dung should be rubbed fine before mixing with the soil. Sow such seeds as Begonias, Campanulas, Carnations, Cyclamens, Gloxinias, Golden Feather, Petunias, Salpiglossis, Stocks, Sweet Peas, etc. Sow small quantities at intervals rather than all at once, keeping the balance in air-tight tins or

bottles. Sweet-peas and Nasturtiums may be sown at once where they are intended to remain. Cuttings of Verbenas, Petunias, etc., should be put in early in the month to be ready for December planting. Supply vacancies in beds and borders. Prune shrubs and trees where necessary. Fork up the soil among shrubberies, burying any decayed refuse. Top-dress or re-pot orchids. Vegetables of all kinds, except potatoes, may be planted out early in the month.

September.—Weather mild and pleasant. Average rainfall 5·78 in. on 18 days. Mean temp. 62 deg. Mulch annuals which have been planted out in June and July, especially those in un-manured beds. Continue supplying vacancies where they occur. Prick out seedlings as they become large enough to handle into boxes or beds under cover. Where the sowings in sheds have been too thick the seedlings must be thinned out, or all the plants will become weak and useless. More sowings should now be made of such seeds as Pansies, Phlox, Dianthus, Nemesia, etc. Keep an eye on young Cinerarias and Stocks for a green caterpillar generally found on the underside of the leaves, also for green-fly; hand-pick the former, and smoke or syringe with soapy water for the latter. Dahlias should be taken up and stored in a dry place for a six weeks' rest before being re-planted in November. Stock manure. Sow vegetables of all kinds, except potatoes, which would suffer from the rains that may be expected during the next few months.

October.—Weather usually wet in the afternoons with the advent of the North-east monsoon. Average rainfall 11·95 in. on 23 days. Mean temp. 62 deg. One of the most suitable months for general planting. Plant up pockets in banks. Re-pot any plants that need it. Prune back Geraniums, Pelargoniums, etc.; water sparingly until new growth has commenced, then re-pot. Insert cuttings of all kinds. Put into small-sized pots Cinerarias, tuberous-rooted Begonias, Gloxinias, etc., increasing the size of pots each time of potting. Where annuals are wanted to be in bloom during the "season" (middle of January to end of May), these should be sown in succession from the middle of November to middle of February. Rose bushes here take two months to come into bloom from the time of pruning, so the latter operation should be carried out according to one's requirements. Vegetables as last month.

November.—Weather wet and dull, often with heavy plumps of rain. Average rainfall 11·29 in. on 21 days. Mean temp. 60 deg. Watch for pests, especially black-grub; the early morning is the best time to catch these. Slugs and insect pests are liable to be troublesome this month. Unslaked lime will destroy them. Green caterpillars are liable to attack Cinerarias and Stocks. The general planting up of beds and borders should be commenced as soon as the seedlings are large enough. Plant out roses, pruning them two or three weeks later. The weather during this and next month is generally suitable for budding and grafting. Put down vegetables of all kinds from now onwards.

December.—Weather often excessively wet and misty. Average rainfall 12·84 in. on 21 days. Mean temp. 58 deg. Weather conditions are generally against plant-growth, the days being sunless and misty, with an almost continual drizzle and heavy plumps at intervals. "Damping off" and

pests are prevalent. Constant attention must be directed to the destruction of pests and the supplying of vacancies. Weeds are apt to become troublesome this month. The surface of the soil should be frequently pointed over, as the continuous rain tends to cake it. Attend to potting of plants generally; this should be about the last shift for flowering plants for the season. Replant strawberries. Cadjans or some similar material should be obtained for covering all plants that are susceptible to frost, which is now liable to occur at night at the higher elevations. Sow vegetables of all kinds.

CALENDAR FOR THE MOIST LOW-COUNTRY

BY THE AUTHOR.

The following general remarks may need modification according to weather, local circumstances and elevation. For average rainfall in principal towns in Ceylon, see page 5.

January.—Weather generally dry, with strong North-east wind. Planting operations in the open should now cease. Collect fallen leaves on lawns, etc., and place in a deep trench to form leaf-mould. Order plants of roses, etc., from abroad, so as to receive them in April or May. Cloves are now in season. These should be collected before the buds open, and spread out on mats to dry in the sun. Tamarinds, pine-apples, and Cochin-goraka are fruits in season. *Congea tomentosa* well in flower.

February.—Usually the driest month of the year, with dry parching winds. The surface soil should be stirred up frequently so as to check the evaporation of moisture. Much watering will be necessary for pot-plants, shrubberies, beds and borders. Overhaul pots and seed-pans, and order new stock if required; these cannot be made so well in rainy weather as now. Syringe pot-plants frequently, at least twice a day in hot dry weather. Repair drives and paths. Mulch surface soil among crops of all kinds. Where practicable, all plants with delicate leaves should be afforded partial shade. Do not water bulbous plants which may now be in a resting state. Flower seeds may be ordered from Europe. Star-apple, pine-apple, and lovi-lovi in season. *Bombax, Jacaranda, Bignonia venusta, Gliricidia* and *Tabebuia* in flower.

March.—Weather dry and hot, and most trees, crops and tender plants suffer from drought. Towards end of month plant out yams, sweet-potatoes. and similar root-crops. Watering, shading and mulching should be the order of the day. Loosen the surface soil frequently where artificial watering is carried on. Syringe pot-plants morning and evening with clean water. Re-potting of plants should be carried out now. Fruits in season: Pine-apple, pomegranate, cannonball tree, velvet-apple and Madagascar clove. In flower:—*Jacaranda, Gliricidia, Spathodea campanulata, Bignonia venusta, Saraca declinata, Amherstia nobilis, Tabebuia, etc.*

April.—Weather hot and muggy, often with thunderstorms. Keep drains, water-channels and culverts clear of leaves and rubbish, and provide means of escape for excessive rain water. Plant out yams and native vegetables of all sorts. Overhaul banana clumps, cutting out barren stems and dried leaves, and burying these round the plants. Orange, jak-fruit, star-apple and bullock-heart in season. *Cassia grandis, Schizolobium, Bignonia*

unguis, Jacaranda, Poinciana, (Flamboyant), *Gliricidia, Sterculia colorata, Hippeastrums, Zephyranthes,* etc., in flower.

May.—The hottest month of the year. Prepare ground for all kinds of vegetable seeds. Procure sticks for supporting peas, beans, etc. Collect potting soil and store away as much manure and leaf-mould as possible before the South-west monsoon rains begin. Re-planting of flower beds and borders should be put in hand, the ground being first well trenched and manured. Fertilise vanilla flowers now in season. Mangoes, cashewnut, pine-apples, etc. in season. *Dendrobium MacArthiae* (" Wesak-mal "), *Michelia Champaca* (Sapu), *Lagerstroemia Flos-reginae, Cananga odorata* (Ilang-ilang) in flower.

June.—If not already arrived, the South-west monsoon is due early in the month. As soon as rainy weather begins sow English vegetables and flower seeds of all kinds. Mow lawns and dig out white-ants' nests. Renovate rockeries and ferneries, applying fresh soil if necessary. Principal fruits in season:—Mango, mangosteen, kamaranga, jambu, breadfruit, cashewnut, Java-almond, nam-nam, sandoricum, soursop. Flowers in season:—*Lagerstroemia flos-reginae, Cassia nodosa, Peltophorum ferrugineum, Kleinhovia, etc.*

July.—Weather usually cool, with moderate rainfall. Plant out fruit, shade, and other useful or showy trees, also general ornamental plants. Attend to propagating work of all kind. Keep down weeds. Earth up root-crops, and stake peas, beans, etc. Mow and roll lawns. Budding and grafting work may now be undertaken. Prune roses which are finished flowering. Flower seeds may be ordered from Europe for sowing in September. Fruits in season:—Mangosteen, mamme-apple, durian, Cochin-goraka. Flowers in season: *Pometia eximea, Porana volubilis. Fagræa fragrans, Ipomœa Brigsii, etc.*

August.—Weather moderately dry. Gardens in the low country should be at their best during this month. Attend to general weeding of vegetable and flower garden, also mowing of lawns. Fork up surface soil between crops, also of beds and borders generally. Attend to the lopping of shade trees which have exceeded their proper limit. Principal fruits in season:—Avocado-pear, mangosteen, durian, sapodilla, guava, coco-plum, goraka, also Hevea or Para-rubber. In flower: *Cassia Fistula, Solanum macranthum,* Teak, etc.

September.—Usually a fairly dry month. Renovate flower-beds and borders, affording mulch to the surface; tie up tender stems or heavy flowers to neat supports. Fresh sowing of English vegetables and annuals should now be made. Repair drives and paths. Fruits in season: Ceylon-gooseberry, nelli, lovi-lovi, soursop. In flower: *Cassia multijuga, Spathodea campanulata, Gloxinia maculata, etc.*

October.—Usually the wettest month of the year. See to the planting of shade, fruit, and wind-belt trees; also of ornamental plants generally. This is a good month for transplanting work. Prune shrubberies, fruit trees, etc. Attend to propagating work of all kinds, also to the re-potting of ornamental plants. Principal fruits in season: Voa-vanga, soursop, custard-apple, bullock's-heart, papaw, and nutmeg (second crop). Principal flowers: *Vanda spathulata, Spathodea.*

November.—Weather usually wet and fairly cool. All general planting work should be completed this month. Pruning or thinning out of shrubs, trees, etc., should now be attended to. Sow peas, beans, beet and other vegetables. Yams are now ripe and should be lifted and stored in sand, in a cool shed. Attend to pollinating Vanilla flowers, now in season. Prune roses that have finished flowering. See to drainage and soil requirements of pot plants. Principal fruits in season: Bullock's-heart, pine-apple, soursop. Flowers: *Aristolochia* (several spp.), *Palicourea, Acalypaya sanderina,* etc.

December.—Generally a moderately wet month, with fairly strong winds. Support all tender plants and young trees in exposed situations, fixing a stout stick in the ground close to the plant, and tying the latter to it. Afford shade to such plants as require it. Collect seeds of flowering plants, annuals, etc., and store when dry in stoppered jars. Collect fallen leaves, and place them in a pit or trench to form leaf-mould. Principal fruits in season: Custard-apple, wood-apple, *Dillenia indica,* and *Elaeocarpus edulis.* Flowers: *Wagatea spicata, Naravelia zeylanica, Pachira insignis, Wormia Burbidgei Humboldtia laurifolia, Alstonia macrophylla,* etc.

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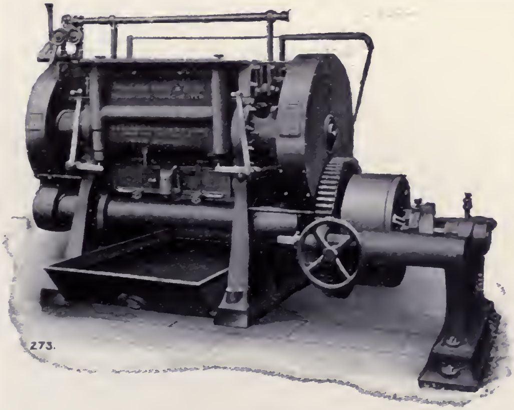

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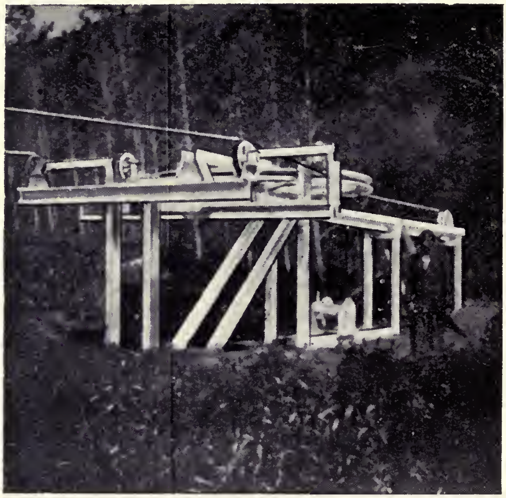

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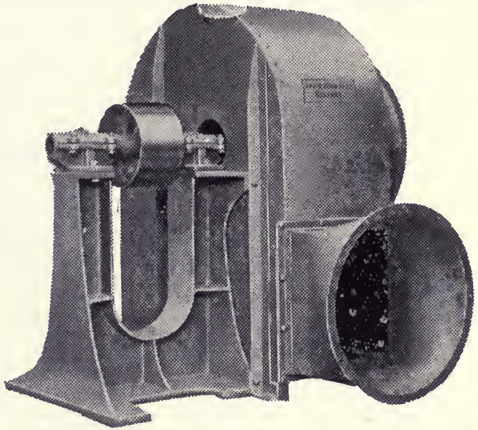

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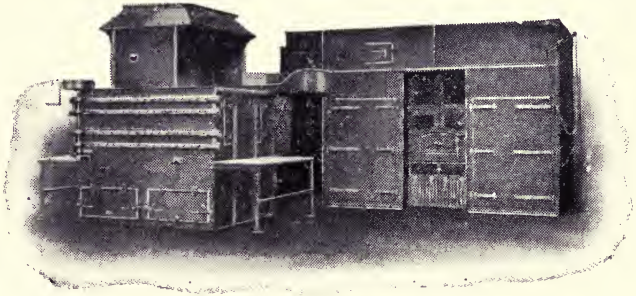

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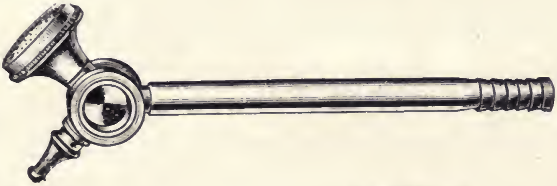

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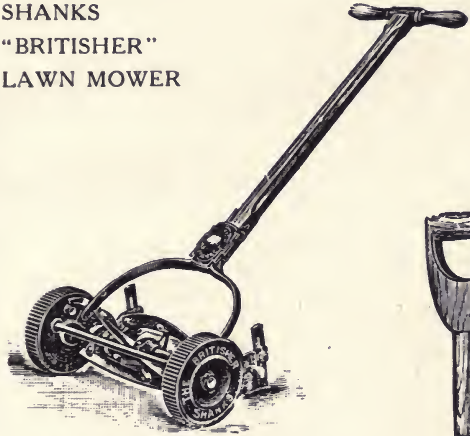

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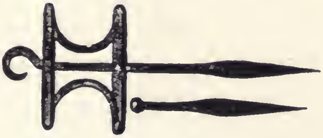

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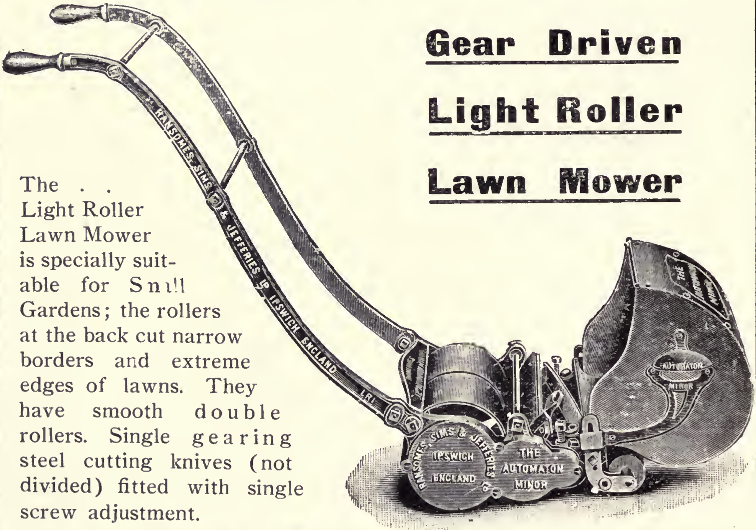

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